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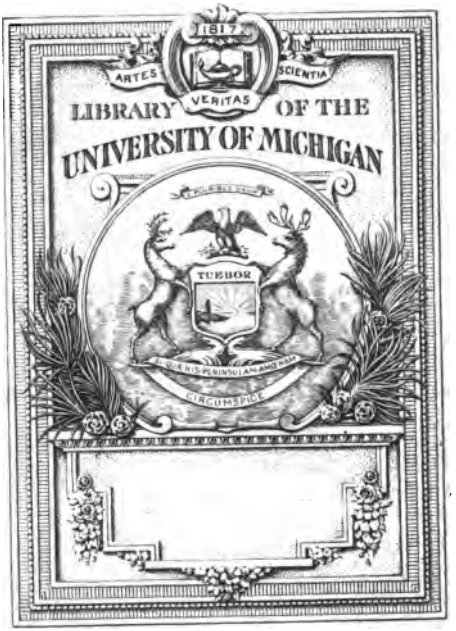
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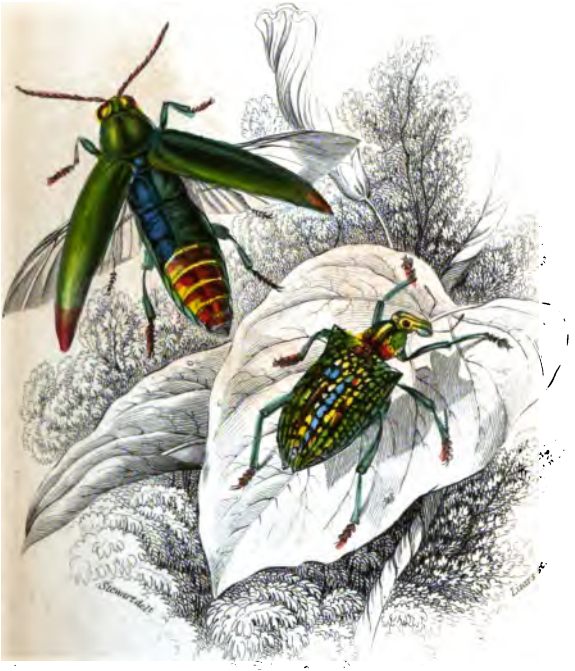

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ENTOMOLOGY.

VOL. II.

BEETLES.

BY

JAMES DUNCAN,
MEMBER OF THE WERNERIAN SOCIETY, &c.

EDINBURGH:
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1835.

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THE

NATURAL HISTORY

OF

BEETLES.

ILLUSTRATED BY THIRTY-TWO PLATES,
NUMEROUS WOOD-CUTS, WITH MEMOIR AND
PORTRAIT OF RAY.

BY

JAMES DUNCAN,
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In all Thirty-two Plates in this Volume.

ADVERTISEMENT.

In prosecution of our design to illustrate all the principal branches of *Zoology*, we now lay before our readers a Volume on ENTOMOLOGY, being the fourth department of the animal kingdom to which the Naturalist's Library now extends. Seven volumes on *vertebrate* animals have been published, viz. four on Ornithology, two on the Mammalia, and one on Ichthyology; and it gives us pleasure to know that our Work is continually rising in the estimation of the Public, a circumstance evinced by the increasing sales of every successive volume, which have reached an extent greatly surpassing our most sanguine expectations. We trust that the same, or even a greater measure of success, will attend our endeavours to illustrate the most interesting departments of the other great division of animals, that, namely, comprising the *invertebrate* tribes. In the numerous and infinitely varied objects which this division presents to our notice, are to be found ample materials for pictorial representation, as well as most interesting historical details; and it may be safely affirmed, that figured illustrations are

much more needed in relation to them than in the case of the higher animals. While the latter have been rendered familiar to most in their general figure and attributes, both through the medium of books and by the frequent exhibition of living examples, comparatively few attempts have been made to make us acquainted with the forms and appearance of the latter, of a nature at all calculated to be accessible to the general public. This is particularly the case with Entomology; for while the descriptive and historical parts of the subject have been worthily treated in several cheap publications, representations of the objects themselves are still to be sought in scarce and costly volumes, which are only to be found in the hands of the professed student of the science, and in many cases are even beyond his reach. Hence it has followed that a knowledge of the properties and habits of insects has become much more general than an acquaintance with their specific forms;—that most school-boys, for example, are familiar with the curious proceedings of the burying-beetle, while few of them could recognize it if it happened to cross their path. In these circumstances, we trust that we have performed an acceptable service by furnishing a volume so copiously illustrated, at a price altogether unprecedented among publications on this subject. No pains have been spared to render it deserving of the favour so liberally accorded to the rest of our series; and when it is borne in mind that no fewer than 110 insects are represented, almost entirely from nature, no one at all acquainted with the expense of preparing original drawings, and of engrav-

ing and colouring so many objects, will fail to appreciate its beauty and cheapness. Our warmest thanks in this, as in every other instance, are due to Professor Jameson, for his obliging use of many of the originals from which the figures have been taken; also to our talented entomological friend, Mr James Wilson, who has allowed us with his usual liberality, the uncontrolled use of his extensive and valuable cabinet; and to other friends, for their various favours.

Some explanation is requisite to account for the circumstance of our second volume on Entomology being the first laid before the public. This has arisen from the first, or introductory volume, being still in a state of preparation. It will soon, however, be completed; and its object will be to give a general and comprehensive outline of the whole subject, with introductions to the various *Orders*, or primary divisions of the Insect Class, illustrated with figures of the most interesting and remarkable objects belonging to each different department.

We now offer our best acknowledgments to our friend the author of the present volume, and hope it will give to others as much pleasure and profitable information as we have ourselves derived from its perusal.

The next volume of the Library, which is on PIGEONS, will be published on the 1st of July, written by Prideaux J. Selby, Esq. of Twizell, author of the *British Ornithology*, &c. &c.

MEMOIR OF RAY.

THE individual of whose life it is proposed to give some account, occupied a distinguished place among the eminent men of the seventeenth century, and contributed materially by his genius and writings to give an impulse to the age in which he lived. He carried his investigations into many of the most important departments of natural science, and, by means of his accurate observation, faithful description, and philosophical talents, placed them on a foundation from which they have been raised to their present state of advancement. These qualities, combined with learning of the first order, and an integrity of life seldom equalled, justly entitle him to the grateful remembrance of his countrymen; and the appellations of "Father of Natural History," "Aristotle of England," and the "Linnæus of his time," which some of them have bestowed on him, sufficiently evince the high sense that has been entertained of his merits.

JOHN RAY was born on the 29th November 1628, at a place named Black Notley, in Essex. Although the name of his family was Ray, he continued all the time he attended the university to write it Wray, a form in which it accordingly appears in the college registers, and in some of his earliest publications. This alteration was soon however abandoned, and he confesses himself to have adopted it inconsiderately, and contrary to the usage of his forefathers. His parents were of humble condition, but they were enabled to provide for the liberal education of their son. His early studies were pursued at the grammar school of Braintree, which was not far distant from the place of his birth. In his maturer years he used to lament that so much of his time had been spent there unprofitably, owing to the imperfect mode of education pursued—a complaint pretty generally applicable to such institutions at the period of which we speak.

We possess no detailed or circumstantial account of Ray's boyhood, nor is it probable that there was much deserving of being recorded in the early part of a life, which was never marked, even at its most active period, by great variety of incident. Whatever may have been the deficiencies of his education at school, they were speedily repaired by his extreme assiduity and aptitude for learning. His attention seems for a time to have been chiefly devoted to the acquisition of languages, and other branches of knowledge bearing immediate relation

to the sacred profession of the church, for which he was destined. But a predilection for the study of nature must have been manifested when he was very young, as we find him mentioned, shortly after entering the university, in terms of high commendation, not only for his knowledge of Latin and Greek, but also for his skill in Natural History.

His removal to the university of Cambridge took place when he was sixteen years of age, for it appears that he was entered at Catherine Hall on 28th June, 1644. He continued there a year and three quarters, under the tuition of Mr Duckfield, when he removed to Trinity College. Here he found the subjects of study greatly more congenial to his taste, as they consisted chiefly of the physical sciences and the more elegant departments of polite learning. He had also the benefit to enjoy the instructions of Dr Duport, an individual of considerable celebrity at that time for his extensive acquaintance with Greek literature. Availing himself to the utmost of these advantages, and extending his enquiries into some departments of learning then very little cultivated, Ray soon acquired a high reputation both for his scholarship and philosophical attainments. At a time when all scientific works, and frequently even the private correspondence of friends, were written in Latin, a facility in the use of that language was not a rare attainment; but a nicer perception of peculiarities of idiom, and a higher tone of classical elegance, are observable in Ray's Latin composi-

tions, than in the writings of most of his cotemporaries. His talents and amiable disposition secured him the esteem and friendship of many of the most eminent men then attending the university, particularly the celebrated Isaac Barrow, Dr Tenison, afterwards archbishop of Canterbury, and Dr Arrowsmith, master of Trinity College. When enumerating the most eminent men to whom he had been tutor, Dr Duport was accustomed to say, that the chief of all his pupils were Mr Ray and Dr Barrow, to whom he esteemed none of the rest comparable.

Ray prosecuted the regular order of study then prescribed to candidates for holy orders, and when of some standing, was chosen into several offices of the college, having been appointed in succession, *Prælector Primarius*, Junior Dean, and College Steward. The latter office he held for two years, and was sworn into it on the last occasion in December 1660.

During his residence at the university, Mr Ray likewise distinguished himself as an eloquent preacher; for it was a common practice at that period to deliver public discourses in the college, previous to ordination. His sermons were much esteemed for sound reasoning, enlightened views of theology, and a judicious application of scriptural principles to the ordinary duties of life; qualities seldom found in the sermons of the time, which were generally either characterized by a spirit of fanaticism, or filled with the unprofitable disquisitions of scholastic theology. Of

the nature and beneficial tendency of his early discourses, we are enabled to judge from some examples that have been preserved, and especially from his valuable Treatise on the Wisdom of God in Creation, and Physico-theological Discourses concerning the Chaos, Deluge, and Dissolution of the World, which in their original form were theological exercises, or common-places, as they were termed, delivered in the college.

The turbulent and unsettled state of the country previous to the restoration, caused Mr Ray to defer his design of taking orders, but the tranquillity resulting from that event seemed to hold out the promise of better times. He was ordained both deacon and priest, by Dr Sanderson, bishop of Lincoln, in the Barbican Chapel, London, on the 23d December, 1660. He continued to be a fellow of Trinity College till the passing of the famous Bartholomew Act in 1662, for enforcing uniformity, by which so many conscientious divines were deprived of their livings. Had this enactment merely required an attestation against the Solemn League and Covenant, there is no reason to suppose that Ray would have refused to comply; for he by no means approved of that oath, and on every occasion showed the warmest attachment to the doctrines and discipline of the Church of England. But a declaration was likewise required, that those who had taken the oath did not lie under obligation to keep it, a requisition which was so repugnant to Ray's prin-

ciples that he did not hesitate to reject it. He was accordingly deprived of his fellowship for non-conformity, along with thirteen others belonging to the university of Cambridge.

Ray's ardent desire of knowledge, and the pleasure he derived from pursuits so congenial to his taste and disposition, led him sooner or later to investigate almost every department of Natural History. But botany, a subject which has attracted so many youthful minds to the study of nature, was the object of his earliest predilection, and it likewise continued throughout the greater part of his life to engross the largest share of his attention. Little had hitherto been done for this science, either in Britain or on the Continent. When Ray first turned his attention to it, it was nearly in the same condition in which Turner had found it about a century before. Almost the only works that treated of plants were styled "Herbals," of which the individual just named might well say, that they were "al full of unlearned cacographees, and falsely naming of herbs." Their use in medicine was the only consideration that recommended plants to attention; and while all the works relating to the subject were, to quote from the title-page of one of them, "compyled, composed, and auctorysed by divers and many noble Doctours and expert Maysters in Medycynes," the object at which they aimed may be gathered from the title of the "Grete Herball," which professed to give "parfyt knowledge and un-

derstanding of all manner of Herbes, and their gracyous vertues which God hath ordeyned for our prosperous welfare and helth, for they hele and cure all manner of dyseases and sicknesses that fall or misfortune to all manner of creatures of God created." Instead therefore of being valued, as they are by modern botanists, for their rarity and beauty, or as supplying a link in the chain of natural affinities, the highest recommendation which plants could possess may be supposed to be similar to that mentioned by the apothecary in the tale, when he found one that was unknown to him, "that it had a fine poisonous smell, and must be good for something!" No trial had been made to form a system of arrangement, and the particular localities of species were very little regarded.

His first work on this subject was named *Catalogus Plantarum circa Cantabrigiam nascentium*, which was published in 1660. It was nothing more than the title imports, a mere catalogue of plants, with the addition of the place of their growth. No generic characters or description of species are given, nor is there any attempt at systematic arrangement, the names being simply placed in alphabetical order.

The favourable manner in which this publication was received, and the impulse it gave (notwithstanding its local reference and uninviting nature) to the study of botany, induced its author to form the design of preparing a similar work applicable to the whole of England. He thus explains his intentions in

a letter to his valued friend Mr Willughby: "You remember that we lately, out of Gerard, Parkinson, and Phytologia Britannica, made a collection of rare plants, whose places are therein mentioned, and ranked them under the several counties. My intention now is to carry on and perfect that design; to which purpose I am now writing to all my friends and acquaintance who are skilful in herbary, to request them this next summer, each to search diligently his countrey for plants, and to send me a catalogue of such as they find, together with the places where they grow. In divers counties I have such as are skilful and industrious. For Warwickshire and Nottinghamshire I must beg your assistance, which I hope and am confident you will be willing to contribute. After that, partly by my own search, partly by the mentioned assistance, I shall have got as much information and knowledge of the plants of each countrey as I can (which will require some years), I do design to put forth a compleat P. B. First I shall give the names of all plants which are or shall then be found growing in England, in an alphabetical order; together with their synonyma. I shall also put a full *Index Anglicolatinus*, after the manner of that in the *Cat. Cant.* Then I shall put in the counties, with the several rare plants in them marshalled alphabetically," &c.* For the accomplishment of this object, but little aid could be de-

* Philosophical Letters, p. 356.

rived from books. The only enumeration of British plants that had been attempted was by William Howe, in his *Phytologia Britannica*, published in 1650. But that work was too meagre and inaccurate to be of much service, and the *Pinax rerum Britannicarum* of Merret, which professed to give the history of every kingdom of nature, was equally undeserving of commendation. Ray was therefore obliged to rely on the contributions of his numerous friends, and his own industry. He travelled through the greater part of England and Wales, zealously investigating the indigenous plants; nor did he neglect the opportunity which these excursions afforded, of examining every thing that was new or interesting either in nature or art. Local and general history, traditions, antiquities, provincial language and manners, occasionally shared his attention with the more direct objects of his research. He kept a journal of his proceedings, in which he recorded his observations, and inserted the localities of the rarer plants. This curious production was published after his death by Dr Derham, under the title of *Itineraries*. In 1661 he made a journey into Scotland, accompanied by his scientific friends Mr Willughby and Mr Skippon, to examine the natural productions of that country, which were even less known than those of England. His route lay through Berwick, Dunbar, and Edinburgh. On their way to the latter place, the party visited the Bass Island,—a spot probably of more interest to the ornithologist than almost any

other of equal extent. His description of the solan goose, of which this rock is well known to be one of the principal haunts, is accurate. "The old ones are all over white, excepting the pinion or hard feathers of their wings, which are black. The upper part of the head and neck, in those that are old, is of a yellowish dun colour. They lay but one egg a-piece, which is white, and not very large: they are very bold, and sit in great multitudes till one comes close up to them, because they are not wont to be scared or disturbed. The young ones are esteemed a choice dish in Scotland, and sold very dear (1s. 8d. plucked). We eat of them at Dunbar. They are in bigness little inferior to an ordinary goose. The young one is upon the back black, and speckled with little white spots, under the breast and belly grey. The beak is sharp-pointed, the mouth very wide and large, the tongue very small, the eyes great, the foot hath four toes webbed together. It feeds upon mackerel and herring, and the flesh of the young one smells and tastes strong of these fish. The laird of this island makes a great profit yearly of the solan geese taken; as I remember, they told us L.130 sterling. They make strangers that come to visit it *Burgesses* of the *Basse*, by giving them to drink of the water of the well, which springs near the top of the rock, and a flower out of the garden thereby."*

His stay in the metropolis of Scotland was very

* Itineraries, p. 191.

short, but he visited the principal public buildings, and gives a brief account of them. From Edinburgh he proceeded to Stirling and Glasgow; from thence to Hamilton and Douglas, the latter of which he calls a pitiful, poor, small place, with scarce a house in it that will keep a man dry in a shower of rain; and re-entered England by way of Dumfries and Carlisle.

Ray does not appear to have derived much satisfaction from his northern tour. He was disappointed in one of his principal objects, as he failed in discovering any new plants.* His remarks on Scotland are frequently made in a spirit of acrimony, which was foreign to the natural placability of his temper. It is probable that he was subjected to much inconvenience on the road, as the country was in a very disturbed state, and the accommodation for travellers of the most indifferent description. Neither were some of his observations on the social condition of the inhabitants of a kind calculated to awaken re-

* We know not on what authority it is asserted (*Brewster's Edin. Encyc.*) that Ray discovered many new plants in Scotland, since he expressly affirms in a letter to Mr Willisel that he found none. The southern division of the country bears so much resemblance to England in all the circumstances that seem to influence the distribution of plants, that scarcely any appreciable dissimilarity is to be expected. The primitive and alpine districts of the north present of course a very distinct vegetation, but these do not appear to have ever been visited by Ray.

gard, or produce agreeable associations. He states that while he was in Scotland, divers women were burnt for witches, to the number, it was reported, of about 120! And during his walks about Edinburgh, one of the spectacles that presented itself was the heads of Argyle and Guthry fixed on the gates of the tollbooth. The following extract contains his opinion of the Scotch, and is of considerable interest in a historical point of view.

"The Scots generally (that is the poorer sort), wear, the men blue bonnets on their heads, and some russet; the women only white linnen, which hangs down their backs as if a napkin were pinned about them. When they go abroad none of them wear hats, but a party-coloured blanket, which they call a plad, over their heads and shoulders. The women generally to us seemed none of the handsomest. They are not very cleanly in their houses, and but sluttish in dressing their meat. Their way of washing linnen is to tuck up their coats, and tread them with their feet in a tub. They have a custom to make up the fronts of their houses, even in their principal towns, with firr boards nailed one over another, in which are often made many round holes or windows to put out their heads. In the best Scottish houses, even the king's palaces, the windows were not glazed throughout, but the upper part only, the lower have two wooden shuts or folds to open at pleasure, and admit the fresh air. The Scots cannot endure to hear their country or countrymen

spoken against. They have neither good bread, cheese, or drink. They cannot make them, nor will they learn. Their butter is very indifferent, and one would wonder how they could contrive to make it so bad. They use much pottage made of coal-wort, which they call *keal*, sometimes broth of decorticated barley. The ordinary country-houses are pitiful cots, built of stone, and covered with turves, having in them but one room, many of them no chimneys, the windows very small holes, and not glazed. In the most stately and fashionable houses in great towns, instead of cieling, they cover the chambers with firr boards, nailed on the roof within side. They have rarely any *bellows* or *warming-pans*. It is the manner in some places there, to lay on but one sheet as large as two, turned up from the feet upwards. The ground in the valleys and plains bears good corn, but especially *beer-barley* or *bigge*, and *oats*, but rarely wheat and rye. We observed little or no fallow grounds in Scotland; some layed ground we saw, which they manured with sea-wreck. The people seemed to be very lazy, at least the men, and may be frequently observed to plow in their cloaks. It is the fashion of them to wear cloaks when they go abroad, but especially on Sundays. They lay out most they are worth in cloaths, and a fellow that has scarce ten groats besides to help himself with, you shall see come out of his smoaky cottage clad like a gentleman."*

* Itineraries, p. 186.

After exploring the natural productions of Britain with so much diligence and success, Mr Ray became desirous of gaining some acquaintance with those of other countries; and for this purpose formed a plan, in concert with his steady coadjutor Mr Willughby, for visiting the Continent. They sailed from Dover in April 1663, accompanied by Mr Nathaniel Bacon, and Mr, afterwards Sir Philip, Skippon, two of Ray's pupils. They passed through the Low Countries, Germany, &c.; traversed Italy, and even visited Sicily and Malta. On their return they spent a considerable time in Switzerland, where Ray is said by Haller to have discovered many new plants, although that was the scene where Gesner and the two Bauhines had laboured so assiduously. The result of his foreign travels was given to the public in 1673, under the title of "Observations topographical, moral, and physiological, made in a journey through part of the Low Countries, Germany, Italy, and France." Mr Willughby separated from the party at Montpellier, and made a tour through Spain, an account of which is likewise included in the volume.

When he returned home, Ray continued to prosecute the study of British plants with unremitting assiduity, and to make excursions to the more remote parts of the country to ascertain their localities. On these occasions he was usually accompanied by Mr Willughby or some other scientific friend, and his researches were not confined to plants, but

extended to various departments of the animal kingdom, particularly birds and fishes. In the summer of 1667 he traversed Cornwall, where he found many plants previously unknown to him, and made observations on the metals found in that county, and the mode of smelting them, which were afterwards published. When not occupied in this manner, he spent much of his time at Middleton-Park in Warwickshire, the seat of Mr Willughby. In a letter from that place to Dr Martin Lister, dated June 1667, he thus describes his occupations: "For my own part, I cannot boast of many discoveries made the last year, save of mine own errors. After I took my leave of you at Cambridge, I divided the remainder of the summer between Essex and Sussex, visiting several friends. My spare hours I bestowed in reading over such books of natural philosophy as came out since my being abroad, viz. Hook's Micrographia, Mr Boyle's Usefulness of Natural Philosophy, Sydenham on Fevers, the Philosophical Transactions, &c. The most part of the winter I spent in reviewing, and helping to put in order, Mr Willughby's collection of birds, fishes, shells, stones, and other fossils; seeds, dried plants, coins, &c.; in giving what assistance I could to Dr Wilkins, in framing his tables of plants, quadrupeds, birds, fishes, &c. for the use of the universal character; in gathering up into a catalogue all such plants as I had found at any time growing wild in England, not in order to the present publishing of them, but

for my own use, possibly one day that they may see the light; at present the world is glutted with Dr Merret's bungling Pinax. I resolve never to put out any thing which is not as perfect as it is possible for me to make it. I wish you would take a little pains this summer about grasses, that so we might compare notes; for I would fain clear and complete their history."

The famous work of Dr Wilkins on a universal character, alluded to in the above letter, subsequently entailed on Mr Ray a great degree of labour; for he undertook, at the earnest solicitation of its author, to translate it into Latin. When this laborious task was accomplished, the manuscript was deposited in the library of the Royal Society, where it has continued ever since, no one having undertaken its publication.

By this time Ray's reputation as an accomplished naturalist and philosopher was fully established, and he had become either the personal friend or correspondent of all the individuals of any eminence who then directed their attention to the study of nature. Of these the best known to modern naturalists are Dr Martin Lister, whose works on testaceous animals, and treatise *De Araneis*, are scarcely yet surpassed for precise description and luminous arrangement; Sir Hans Sloane—the Sir Joseph Banks of his day—whose extensive collections and valuable library (which formed, as is well known, the original nucleus of the present vast assemblage

in the British Museum) contributed so essentially to the progress of natural history; and, at a later period, Dr Derham, the learned and eloquent author of the *Physico* and *Astro-Theology*. He was likewise solicited to become a member of the Royal Society, an institution recently established, but which had already done much in diffusing a taste for the physical sciences, and had given a powerful impulse to the study of natural history. He was admitted on the 7th November 1667, and several papers from his pen afterwards appeared in the Society's Transactions.

The description and classification of vegetables were not the only departments of botany that received illustration from Ray's labours; he likewise ascertained some important facts in their physiology. The theory of vegetation was at this time very imperfectly understood, and every observation founded on careful experiment possessed of value. The accurate investigations of Grew and Malpighi were destined, soon after, to throw a powerful light on this difficult and interesting subject. In the spring of 1669, Ray availed himself of the privileged seclusion of Middleton-Hall, and the observational powers and co-operation of its amiable proprietor, to institute a series of experiments on the motion of the sap in trees. The object was to ascertain the manner in which the sap ascends, and whether it likewise flows through the woody part of the tree. By boring holes of different depth into the trunk

before the expansion of the leaves, it was clearly proved that the sap flows not only through the inner bark, but by all the pores of the wood; for the quantity of sap that issued was found to be in proportion to the depth of the hole. "To put it out of all doubt," says Mr Ray, "we took away, on one side of a birch tree, bark and wood to a considerable depth, and bored an hole into the tree, where the piece was taken away; out of which hole it bled copiously, notwithstanding we carefully prevented any other sap coming on the filter, but what proceeded from the hole." The mucilaginous nature of the sap likewise attracted attention, and Ray ingeniously remarks, that "the white coagulum or jelly which is precipitated, may be well conceived to be the part which every year, between bark and tree, turns to wood, and of which the leaves and fruit are made. And it seems to precipitate more when the tree is just ready to put out leaves, and begins to cease dropping, than at its first bleeding." Experiments of a similar kind seem to have been continued for several years, as we find frequent allusion made to them in Ray's letters to Dr Lister and others of his correspondents. The results to which they led were communicated to the Royal Society, and subsequently published in the Philosophical Transactions.

In his numerous journeys throughout almost every part of England and Wales, Ray had acquired, with that spirit of active enquiry which permitted the

neglect of no branch of useful knowledge, an extensive acquaintance with the proverbial expressions used in different parts of the country, and likewise of the local words and idioms that prevailed in different provinces. Under the impression that such a work might be of use to certain classes of the community, he arranged the proverbs in methodical order, and published them at Cambridge in 1672. Even in this unambitious kind of literary labour, he showed a good deal of philological learning and critical sagacity; and this production, which, he says, he esteems a toy and a trifle, not worth the owning, has made his name known to many of his countrymen, unacquainted with his claims to higher literary distinction. His *Collection of Unusual or local English Words* was published nearly at the same time, and was accompanied with a catalogue of birds and fishes, and an account of the mode of smelting and refining metals as practised in England. In a subsequent edition these accessory articles were omitted, as they had been published separately in a more perfect form.

We learn from a letter to Dr Lister, that about this time he was solicited to accompany three young noblemen to the Continent in the capacity of tutor. This offer he was at first inclined to accept, especially as it offered him the opportunity of examining the alpine plants of Switzerland with more care than he had been able to do on his former visit; but he was obliged to decline it on account of the de-

licate state of his health. The conditions he considered liberal, and the manner in which he expresses himself regarding them, affords an example of that diffidence and humility which were conspicuous in his character. "Ego certe meipsum tali negotio imparem et minus idoneum judico; nec si idoneus essem, puto me tantam mercedem aut stipendium mereri posse. Centum libræ annuatim offeruntur, necessariis omnibus expensis etiam persolutis."*

In the year 1672, Ray sustained an irreparable loss by the premature death of Mr Willughby. They had been fellow-collegians at Trinity College, and the acquaintanceship there formed, was speedily matured by community of tastes and pursuits into the most intimate and endearing friendship. Possessed of ample fortune, family influence, and high mental endowments, Mr Willughby might have attained to some of the most envied objects to which ambition aspires; but his disposition led him to prefer the tranquil enjoyments that flow from the investigation of nature, and the cultivation of the generous affections and contemplative habits which that study is calculated to promote. The zeal with which he laboured, is sufficiently evinced by what he accomplished during his short life; and had Providence spared him to complete the extensive designs he had formed, his name would have occupied a most conspicuous place in the annals of science. The

* Philosophical Letters, p. 72.

distinction that now attaches to it, is chiefly to be attributed to the affectionate care of Ray, who undertook to complete and publish several works which he left imperfect; a task which he executed with so much fidelity and regard to the fame of his deceased friend, that the reader is led to attribute to Mr Willughby much of the merit that belonged exclusively to Ray. These important works will be mentioned more particularly hereafter. They were originally undertaken in conformity with a plan for furnishing a complete history and description of plants and animals, of which the following account is given by Dr Derham, who derived his information directly from Ray. "These two gentlemen, finding the history of nature very imperfect, had agreed between themselves, before their travels beyond sea, to reduce the several tribes of things to a method; and to give accurate descriptions of the several species, from a strict view of them. And forasmuch as Mr Willughby's genius lay chiefly to Animals, therefore he undertook the Birds, Beasts, Fishes, and Insects, as Mr Ray did the Vegetables. How each of these two great men discharged his province, the world hath seen in their works. Mr Willughby's labours were so incessant in his studies, that he allowed himself little or no time for those recreations and diversions which men of his estate and degree are apt to spend too much of their time in; but he prosecuted his design with as great application, as if he had been to get his bread thereby.

All which I mention," adds this amiable writer, "not only out of the great respect I bear to Mr Willughby's memory, but for an example to persons of great estate and quality, that they may be excited to answer the ends for which God gives them estates, leisure, parts, and gifts, and a good genius; which was not to exercise themselves in vain or sinful follies, but to be employed for the glory, and in the service, of the Infinite Creator, and in doing good offices in the world."*

This event exercised a considerable influence on Ray's future life. He was appointed one of Mr Willughby's executors, and at the same time charged with the care and education of his two infant sons; while, as a still further token of esteem, an annuity for life was bequeathed to him. In execution of the trust thus confided to him, it became necessary that he should take up his residence at Middleton-Hall, where ample occupation awaited him, in addition to what arose from the superintendence of his youthful charge, in arranging and completing the MSS. of his lamented friend. He was likewise obliged to interrupt his *simpling* excursions (as Derham calls them), and to decline the generous invitation sent to him about this time by Dr Lister, to come and live with him at York, where he then practised as a physician.

While yet absorbed in grief for the loss of his

* Derham's Life of Ray, p. 48.

best friend, he was subjected to another, scarcely less afflicting, by the death of Bishop Wilkins, an event of which he says that it occasioned him unspeakable loss and grief. The most intimate friendship had long subsisted between Ray and this learned prelate, and the former had been of the most essential service, in drawing up tables of plants and animals for the elaborate work on a Real Character. Through his influence Ray might readily have obtained preferment in the church, but he persisted in a conscientious resolution not to sign the necessary articles.*

Ray's natural sensibility and ardent temperament, made him feel these losses in the acutest manner; but they fell upon a mind deeply imbued with Christian principle, and accustomed to recognise the beneficent appointments of a presiding power, in the most trivial as well as in the most important incidents to which our nature is liable. How much this was the habit of his mind, appears from various

* In reply to a letter in which Dr Lister had expressed a hope that he would avail himself of the influence alluded to, Ray writes, "D. Wilkins, in episcopalem cathedrum evectum, et suiipsius, et mei, et præcipuè ecclesiæ causâ vehementer gaudeo: me tamen per eum ecclesiæ restituturum iri, stante sententia, planè est impossibile, nec enim unquam adduci me posse puto ut declarationi subscribam quam lex non ita pridem lata presbyteris aliisque ecclesiæ ministris injungit, nec tamen tanti est jactura mei qui nulli fere usui ecclesiæ futurus essem, utut (quod dici solet) rectus in curiâ starem."—*Phil. Let.* p. 35.

prayers and devotional exercises, written on occasion of the death of some of his friends, which are calculated to convey an exalted idea of his piety. His social circle being thus diminished, and finding himself with a settled occupation likely to be of considerable duration, he sought to increase his domestic comforts by marriage. His choice was a young woman then residing at Middleton-Hall, named Margaret Oakley, the daughter of a gentleman of that name, belonging to Launton in Oxfordshire. The marriage was celebrated in Middleton church, on the 5th June 1673, Ray being then in his forty-fifth year, and the lady not above twenty.

After this event, he continued to reside at Middleton-Hall, and to superintend the education of his pupils;* a task in which Mrs Ray is said to have lightened his labour by teaching some of the easier branches herself. For the use of his pupils, he composed a small work named *Nomenclator Classicus*, which was first published in 1672. The object of it was to give a correct explanation of Greek and Latin terms, especially such as apply to natural objects; a purpose for which it is said to have been of essential service.

For several years subsequent to his marriage,

* The eldest of these youths was created a baronet when about ten years of age, but died before attaining majority. The younger was raised to the peerage by Queen Anne, under the title of Lord Middleton. Their sister Cassandra became Countess of Caernarvon.

Ray's literary occupations consisted in the preparation for the press of Willughby's book on birds, the completion of some of his own works on botany, and various contributions to the Royal Society. The latter related chiefly to the natural history of the higher animals, but they likewise communicated valuable information regarding insects, spiders, and the myriapodæ. The physiology of vegetation also formed a subject of communication, and on one occasion, at the request of the indefatigable secretary Mr Oldenburgh, who was one of Ray's regular correspondents, the latter furnished one of the philosophical discourses annually read to the society, which was received with great approbation. The subject was, the nature of seeds, and the specific differences of plants. Willughby's observations on birds were written in Latin, and the work was accordingly completed in that language, and published in the year 1675. Nothing was omitted by the editor to render it as complete as possible. The descriptions are frequently of considerable length, and will often be found more correct and satisfactory than many of those contained in the numerous and costly works which have since been devoted to this favourite tribe of animals. Ray afterwards prepared an English translation, to which he made large additions, and gave it to the public in 1678. In this edition, the plates were likewise improved and increased in number; but their execution was by no means satisfactory to Ray, as the engravers were but little experienced

in representing such objects, and his distance from London prevented him from giving efficient directions.

The death of Mr Willughby's mother, which happened about the year 1676, produced a considerable change in Ray's domestic relations. His pupils were taken from under his charge, and he no longer continued to reside at Middleton-Hall. He took up his abode for a time at Sutton Cofield, a few miles distant; but soon removed to Falborne-Hall, in Essex, which was in the vicinity of his native place. During his residence there, his mother died at Black Notley, an event of which the following notice is found in his diary: "March 15, 1678, departed this life, my most dear and honoured mother Elizabeth Ray, of Black Notley, in her house on Dewlands, in the hall chamber, about three of the clock in the afternoon, aged, as I suppose, seventy-eight: whose death, for some considerations, was a great wound to me. Yet have I good hope that her soul is received to the mercy of God, and her sins pardoned through the merits and mediation of Jesus Christ, in whom she trusted, and whose servant she hath been from her youth up, sticking constantly to her profession, and never leaving the church in these times of giddiness and distraction." Shortly afterwards he removed to Black Notley with his family, in which place he intended, as he himself expressed it, to settle, if such was the will of God, for the short pittance of time he had yet to live in this world.

Freed from the interruptions to which he had been for some time exposed, first by his duties as a tutor and guardian, and more recently by his frequent removal from one place to another, he had now the happiness of being able to give that direction to his studies which his inclination prompted, and in which he felt himself fitted to confer most benefit on science. It is observed by Haller, that few have enjoyed to the same extent as Ray, the rare felicity of devoting so many years uninterruptedly to the study of a favourite subject. It may be added, that still fewer have equally improved the opportunities that occurred to them. The works which he completed after his final settlement at Notley are so numerous, that he may be ranked among the most voluminous writers on botany; and while these, together with his publications in various departments of zoology, have established his high reputation as a philosophical naturalist, his admirable treatises on religious subjects, all tending to enforce the observance of practical piety, have gained him the incomparably more enviable distinction, of having benefited his fellow men in the most important interests that attach to their nature. Of the most remarkable of these productions we shall now proceed to give some account; for their collective value is so considerable, that they mark an important epoch in the progressive history of natural knowledge.

The *Methodus Plantarum Nova* issued from the press in 1682. It contains Ray's first attempt to

arrange plants in methodical order. They were distributed in the following manner:

Woody Plants.

Trees....1
Shrubs....2

Herbaceous Plants.

Imperfect....3
Without a flower....4
Capillary....5
Grassy....6
With one naked seed....7
Umbellate....8
Verticillate....9
Rough-leaved....10
Stellate....11
Pome-bearing....12
Berry-bearing....13
Many-podded....14
With one regular petal....15
With one irregular petal....16
Tetrapetalous, siliquose....17
Tetrapetalous, siliculose....18
Papilionaceous....19
Pentapetalous....20
Frumenta, or the different kinds of corn that afford food to men....21
Grasses....22
Grassy-leaved plants....23
Bulbous....24
Allied to the bulbous....25

This arrangement is, to a considerable extent, conformable to that of Cæsalpinus, published in 1583, who was the first to avail himself of Gesner's judicious suggestion to arrange vegetables by means of their fructification. But while the peculiarities of the fruit were continually kept in view, and may be said to form the basis of his method, Ray perceived the propriety of seeking for distinctive characters in the other parts of a plant, in consequence of which he has made a nearer approach to a natural arrangement than any preceding systematist. He has certainly surpassed his predecessor Morison, a native of Aberdeen, and professor of botany at Oxford, whose system was first published at Paris in 1669, and which is greatly more complex than that of Cæsalpinus, without being more useful in the extrication of natural affinities. It will be perceived that Ray adopts the ancient primary division of plants into trees, shrubs, and herbs; although, as Sir J. E. Smith observes, his own prefatory remarks tend to overset that principle, as a vulgar and casual one, unworthy of a philosopher. To this supposed fundamental distinction, however, he continued to adhere, but he soon rectified many of the other errors of his first arrangement, such as the separation of the cereale grasses from their obvious associates, in an improved method subsequently published. This arrangement, which contains his most matured views on the subject, consists of thirty-four classes, distributed as follows:

Herbaceous Plants and Under-Shrubs not bearing Buds.

Imperfect, or without visible flowers	Submarine	1
	Funguses	2
	Mosses	3
	Capillary	4
Perfect, Dicotyledonous	Stamineous, *i. e.* apetalous, with or without a calyx	5
Flower compound	Planipetalous, lactescent	6
	Discoid, with a pappous seed	7
	Corymbiferous	8
Flower simple	Capitate	9
with one naked seed	Monospermous	10
with two naked seeds	Umbelliferous	11
with four naked seeds	Stellate	12
	Rough-leaved	13
	Verticillate	14
with many naked seeds	Polyspermous	15
Seeds covered with a pulp	Pomiferous	16
	Bacciferous	17
in several distinct vessels	Multisiliquous	18

in a single vessel	Monopetalous and Dipetalous	19
	Siliquose	20
	Leguminous	21
Grass-leaved	Pentapetalous	22
bearing flowers	Bulbous or not bulbose	23
without proper flowers	Stamineous grasses	24
	Anomalous	25

Trees and Shrubs bearing Buds.

Monocotyledonous, with arundaceous leaves	Palms	26
Dicotyledonous, flowers remote from the fruit	Apetalous	
	Coniferous	27
flowers contiguous to the fruit	Not coniferous	28
fruit	Umbilicated	29
	Not umbilicated	30
	Dry, not siliquose	31
	Siliquose	32
	Papilionaceous	33
	Anomalous	34

This method, like the former, is in a considerable degree founded on the fruit, but the other parts are adopted without hesitation whenever they afford strongly marked characters of distinction. One of its principal merits consists in assigning a distinct class to the palms, which had scarcely been recognised in any previous system. The arrangement of the other trees, according to the nature of the fructification, which was the most defective part of the first method, is also deserving of high commendation. "But the chief glory of Ray's second method," says the Rev. Mr Wood, "arises from its taking the lead in distributing plants according to the number of their cotyledons. This, indeed, no one would suspect from the tabular view of it, as it stands in *Philosophia Botanica;* nor does it appear in Ray's own table of contents, which Linnæus has very carelessly transcribed and unwarrantably abridged. But the distinction is clearly pointed out and explained in the work itself, into which one would think that Linnæus had never looked. "Floriferas dividemus," is the perspicuous language of Ray, "*in dicotyledones,* quarum semina sata binis foliis anomalis seminalibus dictis, quæ cotyledonum usum præstant, è terra exeunt, vel in binas saltem lobos dividuntur, quamvis eos supra terram foliorum specie non efferant; et *monocotyledones,* quæ nec folia seminalia bina efferunt, nec binos lobos condunt. Hæc divisio ad arbores etiam extendi potest; siquidem palmæ et congeneres hoc respectu eodem

modo a reliquis arboribus differunt quo monocotyledones a reliquis herbis." It is with peculiar satisfaction that we thus do justice to our great British naturalist, and restore to him the honour of which he has been in a great measure deprived. We readily acknowledge that we are proud of being able to call him our countryman, for he was in all respects as good as he was great. How far we may be unduly biassed by natural patriotic feelings, it is not in our power to determine; but while our present convictions continue, we cannot allow a decided pre-eminence to Tournefort. Both of them, indisputably, possessed supereminent excellence, and we cannot but lament that they were not better friends. But *irritabile genus* is a character which might have been extended by the poet much beyond his own fraternity."*

The first work in which he made a practical application of his system, and long before he had rendered it so complete as it appears in the above table, was his general *Historia Plantarum*, of which the first volume, forming a thick folio, was published in 1686. He undertook this work at the request of several of his learned friends, particularly two gentlemen of rank named Hatton, to whom the first volume is dedicated. The second volume appeared about a year afterwards, and a supplementary one was added in 1704. In this arduous undertaking

* Rees' Cyclopædia.

he received considerable assistance from many of his scientific friends, especially Mr Skippon, Sir Hans Sloane, Dr Tancred Robinson, and Mr Dale; but it demanded on his part the most persevering and indefatigable industry. It is truly characterized by Linnæus as *opus immensi laboris*. It embodies all that is valuable in preceding writers, and forms a complete epitome of the botanical lore of the age. It likewise gives the substance of many works, such as the Hortus Malabaricus, which are inaccessible, from their rarity, to the generality of readers. To its value as a compilation are added all the practical knowledge, original observation, and critical discernment of its author. The descriptions are frequently of great length, and in general remarkably accurate. To these are added the place of growth, time of flowering, qualities, and uses. Under the latter head the author has collected much curious and interesting information. The usefulness of this elaborate work is, however, greatly impaired by the difficulty in identifying the species, from the vagueness of the generic and specific characters. This inconvenience would have been in a great measure obviated by the proposal made to Ray by the Bishop of London, to have engraved figures of the whole; but the difficulty of accomplishing this was found to be so great, that the design was ultimately abandoned.*

Two editions of the catalogue of English plants

* Philosophical Letters, p. 319–320.

being now exhausted, Ray began to prepare a third for the press, but the booksellers who had purchased the copyright of the early editions, threw so many obstacles in the way, that he was induced entirely to remodel the work, and publish it in a different form. But as this could not be accomplished for some time, in order, in the mean while, to satisfy the importunity of his botanical friends, he published, in 1688, his *Fasciculus Stirpium Britannicarum post editum Catalogum Plantarum*, &c. The other work appeared in 1690, under the title of *Synopsis Methodica Stirpium Britannicarum*. This publication, in the opinion of one of the most competent judges, Sir J. E. Smith, is the great corner stone of his reputation in this department of science. "Of all the systematical and practical floras of any country, the second edition of Ray's synopsis is the most perfect that ever came under our observation. He examined every plant recorded in the work, and even gathered most of them himself. He investigated their synonyms with consummate accuracy; and if the clearness and precision of other authors had equalled his, he would scarcely have committed an error. It is difficult to find him in a mistake or misconception respecting nature herself, though he sometimes misapprehends the bad figures or lame descriptions he was obliged to consult."* The second edition, above referred to, was published in

* Trans. Linn. Soc. iv. 277.

1696, with the addition of more than a hundred species, and a history and arrangement of mosses, mushrooms, fuci, and other cryptogamous plants. The edition now most in use, is that published many years after the author's death by the celebrated Dillenius.

Although our accomplished naturalist was so much occupied with his botanical labours, and writes to one of his correspondents that he resembled him who said, *Pectora nostra duas non admittentia curas*, yet such was his industry, that he was enabled to prepare for the press the valuable but incomplete and ill-digested materials left by Mr Willughby for a general history of fishes. As the pecuniary aid which was liberally contributed by Willughby's relations to the former work was in this instance withheld, the book was printed, through the interest of Bishop Fell, at the theatre in Oxford, and the expense of the plates defrayed by several members of the Royal Society. The *Historia Piscium* forms a folio volume, and is illustrated by 188 plates. It is a valuable contribution to the natural history of a class of animals which, after quadrupeds, are of the greatest utility to man, but which are less known, notwithstanding the recent exertions of Lacépède, Cuvier, and Valenciennes, than any other department of the animal kingdom.

It had always been matter of deep regret to Ray that he was prevented from engaging in the active duties of his profession: his earnest desire to pro-

mote the spiritual good of others led him, therefore, to attempt through the press what he could not accomplish otherwise. The subject which he first selected for this purpose was admirably fitted to call forth the qualities in which he most excelled, and his instructive and enlightened manner of treating it has been acknowledged by all. "The Wisdom of God, manifested in the Works of the Creation," the volume to which we allude, has been universally admired as an able exposition of the power, the goodness, and other attributes of the Deity, as they are reflected from the mirror of creation, and as far as they can be "understood by the things that are made." The tendency of his studies, and the characteristic qualities of his mind, enabled him to illustrate the subject with a profusion of facts and observations of the most interesting kind; and the work is pervaded by a spirit of sound philosophy and ardent piety, which confer on it a high value. Such was its popularity, that it soon passed through many editions, and was translated into several languages. It has suggested the plan, and furnished many of the most valuable materials, of most of the works that have since been written on the same topic, and has made the name of Ray familiar to the generality of readers even in the present day.

The success of this work led him to prepare another of a somewhat similar nature, entitled "Physico-Theological Discourses concerning the primitive

Chaos, and Creation of the World: the general Deluge, and Dissolution of the World;" which was published in 1692, and dedicated to Archbishop Tillotson. Although little known in the present day, this work excited considerable attention at the time it appeared, and soon went through several editions. It is a striking proof of the extent and variety of knowledge which its author possessed; and, independent of its theoretical views, contains such an assemblage of facts relating to the structure of the earth, and the changes which it has undergone, that it has not yet altogether lost its utility.*

In compliance with the urgent solicitation of Dr Tancred Robinson, Ray undertook to prepare a series of synoptical arrangements of such of the other classes of animals as had not been included in his former publications; thus furnishing a view almost of the whole system of nature. The first of these works was the *Synopsis Methodica Animalium Quadrupedum, et Serpentini Generis*, which appeared in 1693. Besides a systematic classification of these animals, it gives a pretty full account of their forms and internal structure, and is enriched with numerous important observations, and interesting details, illustrative of their habits and instincts. It was in general use among naturalists till the year 1735, when it was superseded by the system of Linnæus.

* Pulteney's Sketches of the Progress of Botany in England, vol. i. p. 239.

This was followed by a *Synopsis Methodica Avium et Piscium*, in which many species are inserted which had become known to the author since the publication of Willughby's works on the same subjects. Owing to the negligence of the bookseller to whom the copy had been sold, this volume was not given to the world till after Ray's death, when it appeared under the superintendence of Dr Derham, who added several descriptions, together with a series of figures.

Our distinguished author was now considerably upwards of sixty years of age, and his constitution, naturally feeble, had been severely tried by his studious and sedentary mode of life. After completing so many useful works, he was pleased, we are told by his biographer Dr Derham, by indulging the thoughts of reposing from his labours. But notwithstanding his bodily infirmities, his mind was still vigorous; and he did not hesitate to engage in another literary undertaking, at the request of his friends. This was to revise and correct an English edition of Rauwolf's Travels in Asia, translated from the High Dutch by Mr Staphorst, a native of Germany. This work contained a good deal of information on many subjects in natural history, and to make it more perfect in this respect, Ray added a catalogue of the plants of Greece, Syria, Egypt, and Crete. It was published, with several rare tracts annexed, in 1693.

Some time after his return from the Continent,

he had published a *Catalogus Stirpium in exteris regionibus*, &c. which was now out of print; and his attention being recalled, by Rauwolf's book, to exotic botany, he conceived that it would be of advantage to travellers to have a condensed view of the vegetables of Europe, exclusive of those indigenous to Britain, which were sufficiently illustrated in his other works. He accordingly collected all that were mentioned by authors, and added them to such as he had himself discovered. This volume appeared in 1694, and was entitled, *Stirpium Europæarum extra Britannias nascentium Sylloge.* The plants are arranged in alphabetical order, and, besides the addition of various lists from Boccone's Plants of Sicily, and other works, there is subjoined a geographical view of the species which he observed on the Continent; perhaps the earliest attempt to illustrate the distribution of vegetables that had been made. In the preface to this book he discusses the merits of a method of arranging plants, proposed by Rivinus, professor of botany at Leipsic, which led to a controversy with that author. The method of Rivinus is entirely artificial, and is founded on the regularity and irregularity of the corolla, and the number of petals of which it is composed. It has the appearance of great simplicity, but leads to many very unnatural combinations, and is in reality of difficult and vague application, as the flowers are more liable to vary in the number of their petals than almost any other part of structure. He was the first

who pointed out the inaccuracy of the division of plants into trees, shrubs, under-shrubs, and herbaceous, a distinction which had been almost universally adopted, and which was warmly defended by Ray, who unaccountably made it the groundwork of his arrangement, although he had declared it to be unphilosophical. Although this controversy was carried on with less personal recrimination than usually characterizes such discussions, it was by no means agreeable to Ray, whose Christian principles, no less than the amenity of his disposition, rendered him desirous to live in peace with all men. The principal benefit that resulted from this altercation, was the improvement which it led him to make in his method of arrangement. These improvements were embodied in the *Methodus Plantarum nova emendata et aucta*, and are exhibited in the second tabular view which we have given on a former page. Owing to some difficulty in effecting an arrangement with the London booksellers for the publication of this work, it was printed at Amsterdam, under the care of Dr Hotton, professor of botany at Leyden; and its wide diffusion on the Continent made Ray's name as a botanist of European celebrity. It was published in 1703, and is the last of his botanical labours.

While engaged in its composition, the infirmities of age were rapidly accumulating. He writes to Dr Robertson that he was quite unable to go to London to examine the different collections of plants,

and that he could not so much as walk into the neighbouring fields. He had laboured for some years under a severe disorder in his legs, which had broken out into ulcers, and occasioned excessive pain. He was likewise seized with other complaints, by which his strength was so much reduced, that it became evident that his mortal career was approaching its close. But study had now become so habitual to him, that he did not cease, even under these circumstances, from prosecuting the investigation of nature, and even entering upon subjects comparatively new to him. It had formed part of Willughby's plan to write a history of insects, and Ray had at an early period given occasional attention to the subject, with a view of assisting in that undertaking. He now resolved to complete the work himself. In reference to it, he writes to Dr Derham: "The work which I have now entered upon is indeed too great a task for me; I am very crazy and infirm, and God knows whether I shall overlive this winter. Cold weather is very grievous to me; besides, I have not bestowed sufficient time and pains in the quest of any tribe of insects, except *Papilio's*, and I have told how far short I am of perfection in that. I rely chiefly on Mr Willughby's discoveries, and the contributions of friends." On another occasion he writes to the same individual, "For my part I am now almost three score and fifteen years of age, so that it is time for me to give over these studies and enquiries (he alludes to the history of

insects, which he had been recommending Dr Derham to pursue); and, besides, I am so lame, and almost continually afflicted with pain, that I cannot attend any study, being diverted by pain. 'Tis true, of late years I have diverted myself by searching out the various species of insects to be found hereabouts; but I have confined myself chiefly to two or three sorts, viz. Papilios diurnal and nocturnal, Beetles, Bees, and Spiders. Of the first of these I have found about 300 kinds, and there are still remaining many more undiscovered by me, and all within the compass of a few miles. I have now given over my inquisition, by reason of my disability to prosecute, and my approaching end, which I pray God fit me for. You that have more time before you may profitably bestow some of your spare hours upon such enquiries, and may probably make useful discoveries, at least may reap a great deal of pleasure and satisfaction in finding out and bringing to light some of the works of God not before taken notice of." But before his increasing infirmities obliged him to abandon this study—the last that occupied the attention of his active mind—he had prepared pretty copious materials for a history of insects, which was published after his death by Dr Derham, at the expense of the Royal Society. It comprises all Willughby's descriptions in addition to his own, and forms a small quarto of 398 pages, including an appendix on British Beetles by Dr Lister. The descriptions are frequently of con-

siderable length, particularly those of the butterflies, but their value is greatly diminished by the difficulty in determining, owing to the want of plates and precise characters, to what particular species they were designed to apply. Prefixed to the work there is a systematic arrangement of insects, which was at first published by itself under the title of *Methodus Insectorum*. He divides insects, including under that name intestinal vermes, earth-worms, and leeches, into two primary sections; those which undergo transformation, and those which do not change their form. The orders are variously characterized by the want or presence of feet, place of abode, structure of the wings, form of the caterpillar, &c. The following is a tabular view of this arrangement from Kirby and Spence's Introduction, which these admirable authors have compressed into as small a space as possible, by using the Linnæan terms for metamorphoses, and reducing Ray's tribes of *Orthoptera*, *Hemiptera*, and *Neuroptera*, to their modern denominations.

INSECTA.

- *Ametamorphota*
  - *Apoda* — *Terrestria*, *Aquatica*.
  - *Pedata*
    - *Hexapoda* — *Terrestria* (*Magna*, *Minora*), *Aquatica*, *Caudata*.
    - *Octopoda* — *Non-caudata*.
    - *14-poda*.
    - *24-poda*.
    - *30-poda*.
    - *Polypoda* — *Terrestria* (*Cylindrica*, *Compressa*), *Aquatica* (*Corpore teresi*, —— *plano*, *Bicaudata*).
- *Metamorphosema*
  - Metamorphosis semicompleta — *Orthoptera*, *Heteroptera*, *Homoptera*, *Libellulina*, *Ephemerina*.
  - Metamorphosis incompleta vel obtecta
    - *Coleoptera*.
    - *Anelytra*.
    - *Diptera* — Alis farinaceis; Alis membranaceis.
    - *Tetroptera*.
  - Metamorphosis coarctata — *Muscidæ et Tenuicornes minuti, L.*
    - Gregaria et Favilica — *Mellifica*, *Non mellifica*, *Apiformia*.
    - Solitaria non Gregaria et Favilica — *Vespiformia*, *Papilioniformia*, *Scricauda*, *ens T-ipilia*.
    - *Breviora*.
    - *Anguslora*.

This classification possesses considerable merit. The praise, it is true, of assuming the metamorphoses of these animals as the basis of a natural arrangement, is due to Swammerdam, but in many other respects Ray has improved on the method of his illustrious cotemporary. He has indicated and characterized several natural groups with great accuracy; and many of his suggestions have not been without influence in leading to the present improved state of entomological science. Of the imperfections of his arrangement no one was more fully aware than himself. He laments especially the inaccuracy of that part of it relating to flies, and expresses a hope that he should soon be able to furnish another more complete.* This expectation, however, was destined never to be realized.

His vital powers were gradually exhausted by repeated attacks of disease, and he breathed his last at his residence in Black Notley, on the 17th January 1705. He was buried in the church-yard of his native parish, where a monument was some time afterwards erected to his memory, by the care of Bishop Compton, and others of his friends. It was inscribed with the following elegant Latin epitaph from the pen of the Rev. William Coyte, M. A.

* Hist. Insectorum, p. 109.

Eruditissimi Viri JOHANNIS RAII, A. M.
Quicquid mortale fuit,
Hoc in angusto tumulo reconditum est.
At *Scripta*
Non una continet Regio:
Et Fama undequaque celeberrima
Vetat Mori.
Collegii S. S. Trinitatis Cantab. fuit olim Socius,
Necnon Societatis Regiæ apud Londinenses Sodalis,
Egregium utriusque Ornamentum.
In omni Scientiarum genere
Tam Divinarum quam Humanarum
Versatissimus.
Et sicut alter Solomon (cui forsàn Unico Secundus)
A Cedro ad Hyssopum,
Ab Animalium maximis, ad minima usque Insecta,
Exquisitam nactus est Notitiam.
Nec de Plantis solùm, qùa patet Terræ facies
Accuratissimè disseruit;
Sed et intima ipsius viscera sagacissimè rimatus,
Quicquid notatu dignum in universa Natura descripsit.
Apud exteras Gentes agens,
Quæ aliorum Oculos fugerent, diligenter exploravit,
Multaque scitu dignissima primus in Lucem protulit:
Quod superest, eâ Morum Simplicitate præditus,
Ut fuerit absque Invidia Doctus;
Sublimis Ingenii,
Et, quod rarò accidit, demissi simul animi et modesti;

Non Sanguine et Genere insignis,
Sed quod majus,
Propria Virtute Illustris.
De Opibus Titulisque obtinendis
Parum solicitus,
Hæc potius mereri voluit quam adipisci:
Dum sub Privato Lare, sua Sorte contentus
(Fortuna lautiori dignus) consenuit.
In rebus aliis sibi modum facilè imposuit,
In Studiis nullum.
Quid Plura?
Hisce omnibus,
Pietatem minime fucatam adjunxit,
Ecclesiæ Anglicanæ
(Id quod supremo halitu confirmavit)
Totus et ex Animo addictus.
Sic bene latuit, bene vixit Vir beatus,
Quem Præsens Ætas colit, Postera mirabitur.

We are told by Sir James Edward Smith, that in 1737, the monument bearing the above inscription having gone very much to decay, it was restored at the charge of Dr Legge, and removed for shelter into the church. Forty years afterwards, the tomb again underwent a repair by the care of the present Sir Thomas Grey Callum and others,* who subjoined a third inscription, as follows :—

* It has been again repaired by Mr Walker, the Rector of Black Notley.

Tumulum hunc
a nonnullis humanitati, et scientiæ
naturali, faventibus,
olim conditum,
et aliorum bonâ diligentiâ
postea restauratum, 1737,
nunc e vetustatis situ et sordibus
pauci de novo revocarunt, 1792.
ανδρων επιφανων απασα γη ταφος.

The era in which Ray flourished, is justly described by Linnæus as the dawn of the golden age in natural history. In the period that preceded it, the thick darkness that settled, during the middle ages, on almost every subject worthy to occupy the human faculties, still continued to overshadow the history of nature. Scarcely any effort was made to elucidate even the most familiar phenomena; and when such was attempted, the want of observation and philosophical discernment was supplied by fictions of the imagination and the extravagancies of credulity. Since what had been seen and ascertained was therefore trifling in amount compared with what had been heard and conjectured, it is not surprising that the few works of the time devoted to natural history, should so abound in absurd notions and fictitious representations of animal forms, as to be useful for nothing but pointing out the illusions to which mankind have been subject. The investigations of Ray and his co-

temporaries, pursued in the rigorous spirit of the inductive philosophy, soon dissipated these delusions, by bringing every thing to the test of strict observation. One of the first fruits of this auspicious change, was the triumphant refutation of the doctrine of equivocal or spontaneous generation, which had maintained its place among the unquestioned credenda of the schools from the time of Aristotle, and the full establishment of the Harveian doctrine, *omnia ex ovo*. Sound principles of classification were likewise adopted, and improvements equally important introduced into every department of natural science, forming a broad and stable foundation for the stately superstructure which has since been reared.

How much Ray's individual exertions contributed to this effect, will in some measure appear from the brief view that has been given of his life and writings. He enjoyed the advantage of devoting the greater part of his life without interruption to the studies that he loved so well; and this circumstance, joined to his indefatigable industry and activity, enabled him to accomplish more than most other authors. There is scarcely any department of natural history which did not receive illustration from his pen; he greatly extended the boundaries of many of them, and the systematic study of some may almost be said to have originated with him. His mind was equally fitted for the minute and laborious investigation of objects, and that nice perception of their remote and general relations which can

only be attained by the exercise of the higher faculties. Hence he excelled both as a faithful describer of species and a framer of systems. In comparing the latter with the more celebrated method of Linnæus, it ought to be borne in mind that the two systematists had, in a great measure, different objects in view; and that if our countryman was least successful, he failed in a more difficult object than that to which the other so admirably attained. Linnæus adopted an artificial system, of which the only recommendation is the ease with which it enables students to ascertain the names of plants. Desirous that this knowledge should not be obtained in an empirical manner, Ray attempted to follow the divisions of nature; and if he could not trace the Ariadnean thread, he failed in a purpose which has not yet been fully accomplished. Linnæus was deeply indebted to Ray's various writings, particularly in his arrangement of animals; and a careful perusal of the Synopsis Quadrupedum, and the early editions of the System of Nature, will lead to the wish that the obligation had been more warmly acknowledged. Had not Ray and his cotemporaries performed the office of pioneers in opening a way for the illustrious Swede, the energies of his comprehensive mind might have been engrossed with the subordinate details of science, and his progress obstructed to that commanding elevation which he now occupies.

Fully to appreciate Ray's merits, we must not

only take into account the vast increment of knowledge which resulted to natural history from his labours, but also the discredit from which he rescued the study. Even the history of the higher animals, though bearing so directly on the interests of life, was held in little repute, while the lower tribes were regarded as too insignificant to merit or justify attention. This was particularly the case in relation to insects and other "creeping things," the examination of which was considered as egregious trifling, and deserving of nothing but ridicule and contempt. To such an extent did this prejudice prevail, that on one occasion an attempt was made to set aside the will of a Lady Glanville, on the ground of lunacy, because she had shown a strong partiality for insects, and Ray had to appear on the day of trial to bear testimony to her sanity! By his means, however, even the most disreputable of these studies was placed in a proper light, and invested with the dignity of a philosophical pursuit; and although it was not till a remotely subsequent period that many of them were cultivated with that zeal which their intrinsic interest is fitted to inspire, yet a feeling was produced in favour of all, when they were seen to form the favourite occupation of a mind which had asserted its superiority in the most approved walks of learning, and which did not disdain to exercise its matured faculties in contemplating the lowest and most despised of nature's productions, even at a time when all earthly inte-

rests were beginning to lose their influence in the near anticipation of the most glorious manifestations of the Creator.

His varied and useful labours have justly caused him to be regarded as the father of natural history in this country; and his character is in every respect such as we should wish to belong to the individual enjoying that high distinction. His claims to the regard of posterity are not more founded on his intellectual capacity than on his moral excellence. He maintained a steady and uncompromising adherence to his principles, at a time when vacillation and change were so common as almost to escape unnoticed and uncensured. From some conscientious scruples, which he shared in common with many of the wisest and most pious men of his time, he did not hesitate to sacrifice his views of preferment in the church, although his talents and learning, joined to the powerful influence of his numerous friends, might have justified him in aspiring to a considerable station. The benevolence of his disposition continually appears in the generosity of his praise, the tenderness of his censure, and solicitude to promote the welfare of others. His modesty and self-abasement were so great that they transpire insensibly on all occasions; and his affectionate and grateful feelings led him, as has been remarked, to fulfil the sacred duties of friendship even to his own prejudice, and to adorn the bust of his friend with wreaths which he himself might justly have assumed.

All these qualities were refined and exalted by the purest Christian feeling, and the union of the whole constitutes a character which procured the admiration of cotemporaries, and well deserves to be recommended to the imitation of posterity.*

* While the natural sciences are rapidly advancing in discovery, it is pleasing to find their most ardent cultivators cherishing the recollection of this great man with such feelings as pupils entertain towards an aged and revered preceptor; wondering at the ability with which he used the opportunities within his reach, and anxious that his memory should be honoured by the generations of after days. A few years since, some of the admirers of Ray in London proposed that his memory should be commemorated by some appropriate meeting. The proposal was enthusiastically received by the leading naturalists of the metropolis and its vicinity, and the 29th November 1828, the second centenary of his birth-day, was selected for the purpose of a public expression of the high estimation in which he was held by the lovers of every branch of natural history. One hundred and thirty of the most distinguished cultivators and patrons of science gave a public dinner, at Free-masons' Hall, Davis Gilbert, Esq. president of the Royal Society, in the chair, and spent the evening admiring his genius, and anxious to use their best endeavours for the future commemoration of his piety and learning.

For the particulars of this meeting, see *Annals of Philosophy*, vol. v. p. 140.

ENTOMOLOGY.

NATURAL HISTORY

OF

COLEOPTEROUS INSECTS.

"Si vous parlez d'une pierre, d'une fourmi, d'un moucheron, d'une abeille, votre discours est une espèce de demonstration de la puissance de celui qui les a formées; car la sagesse de l'ouvrier se manifeste pour l'ordinaire dans ce qui est le plus petit. Celui qui a étendu les cieux, et qui a creusé le lit de la mer, n'est point différent de celui qui a percé l'aiguillon d'une abeille, afin de donner passage à son venin."—*St Basil*, LYONNET'S TRANS.

THE numerous beings comprehended under the name of Insect, offer to our regard so many interesting objects of contemplation and research, that their history has deservedly assumed a prominent place among the natural sciences. Although not to be compared with many other animals in direct utility to man, they are by no means destitute even of the interest produced by that consideration,

while they possess advantages as a subject of study and investigation, equal to almost any other branch of zoology. Such is the extent of the subject, and the variety of aspects in which it may be viewed, that minds of very different tastes and capacities may find congenial occupation in some one or other of its numerous details. The investigation of generic and specific distinctions, which are often so faint and evanescent as almost to elude observation, accustoms the eye to habits of nice discrimination, —the relations which groups and families bear both to each other and to the different kingdoms of nature, lead to general views sufficient to exercise the faculties of the most gifted minds,—while the variety of form and structure which the species present, is the source of inexhaustible gratification to those who delight to trace the footsteps of the Creator in his works. When to the consideration of their forms and habits we add the internal anatomy of insects, what a wide and fruitful field of enquiry is laid open! The celebrated Lyonnet spent a considerable portion of his life in examining the structure of a single insect, and yet left much to be supplied by his successors to complete our knowledge even of that individual species. In the body of an insect not exceeding an inch in length, M. Straus has enumerated 306 hard pieces entering into the composition of the outer envelope; 494 muscles for putting these in motion; 24 pair of nerves to animate them, divided into innumerable filets; and 48 pair of tra-

cheæ, equally ramified and divided, to convey air and life into this inextricable tissue. This is a spectacle, says Cuvier, altogether transporting by its delicacy and regularity. Even to the fine assortment of its colours, every thing seems as if made on purpose to please the eye of man, which now perhaps looked upon it for the first time since the creation.* —Each tribe of this extensive class of animals possesses peculiar attributes deserving of our regard. The extreme beauty of the Lepidoptera or butterflies,—the striking contrast they present in the different stages of their existence, so remarkable as to have caused them to be regarded by a mystical philosophy as the types of the human soul released from its material encumbrance,—their habits and times of appearance, the one suggesting the purity of an ethereal nature, the other associating them in the mind of the observer with the beauty of external nature, and the genial influences of the seasons,—have alike contributed to render them objects of general favour. The absence of imposing forms and splendour of ornament among the *Hymenoptera*, is amply compensated by their interesting habits, and beautiful adaptation of structure to the perfect fulfilment of those wonderful instincts which in every age have excited the admiration of mankind. Without possessing in equal perfection the beauty of the Lepidoptera, or the exquisite economy of the

* Rapport sur l'Histoire Naturelle.

hive-bee, the Coleoptera partake in no inconsiderable degree of the interest arising from both these sources, while they offer some claims on our attention peculiar to themselves.

In consequence of the compactness and solidity of their structure, and symmetrical perfection of their forms, the greater number of writers on entomology have been led to follow Linné, in assigning to the Coleoptera the precedence over the other tribes in their systematic classifications. The distinctness of their insections and articulations, together with the clearly defined figure of the organs of manducation, render them the most characteristic representatives of the class to which they belong; while certain relations of analogy which some of the species are thought to bear to the vertebrated tribes, seem to point out their relationship to a superior race of beings. They may be said to symbolize those higher animals which are most remarkable for the perfection of their organs, and which are therefore regarded as the types of their respective classes, such as the feline race among quadrupeds, and eagles among birds. These considerations, taken in connexion with the great size, singular forms, and brilliant colouring, of many of the species, as well as the ease with which they can be preserved in much of their living beauty, have long rendered them favourite subjects of study with those who have devoted their attention to annulose zoology. At the same time, the important

functions which they perform in the economy of nature, and the injurious consequences which not unfrequently result to mankind from their undue diminution or increase, impart a greater degree of importance to their history than attaches to the generality of the insect tribes.

Coleopterous insects compose the first great section, or *order* as it is called, of the class of insects. They are readily distinguished from the other members of their class, by having the inferior wings covered and protected by a hard case or shell. This peculiarity of structure has suggested the name, which is composed of two Greek words, and signifies *wings in a sheath* (κολεος, *a sheath*, and πτερα, *wings*). The term was first used by Aristotle, and as the character to which it refers forms a very obvious mark of distinction, it has been almost universally adopted by subsequent writers. In several instances, however, it fails to be an accurate definition of the order, for there are some beetles without either wings or sheath, and many others in which the latter only is present. To the other characters more recently added, such as the transverse folding of the wings, and the straight sutural line down the middle of the wing-cases, separating them into two equal portions, there are likewise exceptions; but these are too few and unimportant to invalidate materially the general correctness of the definition.

The insects to which these characters apply, constitute one of the most numerous orders of their

class. In this country alone, they amount, by the latest and most accurate *census*, to upwards of 3600, thus forming nearly a third part of our entire insect population. This is considerably more than double the number of phænogamous or flowering plants indigenous to Britain, and greatly exceeds the whole amount of our native vertebrate animals. When compared with the two other orders that are next to it in extent in this country, it will be found that the Coleoptera are nearly one half more numerous than the Lepidoptera, and that they stand much in the same relation to the Diptera or two-winged flies. Of the latter, indeed, all the species ascertained to inhabit Europe scarcely exceed the amount of British Coleoptera; for the most accurate enumeration of the European Diptera which we possess makes them about 3760.* The native Coleoptera of Sweden, according to the enumeration of them given by Gyllenhal, in his admirable *Insecta Suecica*, are about 4700 in number. In advancing southwards, these insects increase in a ratio similar to what is observed in other departments of nature; and in countries under the tropics, so redundant in every kind of animal life, they may be said absolutely to swarm. We are without sufficient data, however, from which to form an accurate estimate of their total amount. Some years since, the collection of

* Systematische Beschreibung der bekannten Europaischen zweiflugeligen Insekten, von J. W. Meigen. Aachen, 1818–1830.

the Count de Jean at Paris, one of the most extensive that exists, contained no fewer than 20,000 species. Many others are no doubt to be found in different collections; and when we take into account the discoveries daily made by the numerous cultivators of this branch of zoology, and the extent and fertility of the countries with the insect productions of which we are wholly unacquainted, there seems reason to believe that it cannot be much short of 30,000—that is 10,000 above the estimate formed by Ray nearly a century and a half ago, as the probable amount of the whole class of insects!

This order comprehends some of the largest as well as the most minute insects with which we are acquainted. Certain *orthopterous* species belonging to the genus *Phasma* surpass them in length, and several gigantic moths are of greater superficial extent; but in many beetles length of body is combined with a proportionate breadth and thickness, which renders them the most bulky and massive of their class. A fine specimen of Prionus giganteus measures nearly half a foot in length, the breadth is about two inches, and the expansion of the wings is nine inches. A handsome and scarce species of the same family (*Prionus armillatus*) is about five inches long and one inch and three quarters broad, and the antennæ, which are very strong and rigid, are upwards of six inches in length. The Hercules beetle (*Dynastes Hercules*), and Scarabæus Actæon, measure respectively about four and a half inches in length

including the horns. The largest coleopterous insects inhabiting Britain are the *Hydröus piceus*, and the Stag-beetle (*Lucanus cervus*). The latter is nearly two inches in length, including the mandibles; and the former is not much short of the same dimensions, besides being of considerably greater breadth. These may be regarded as the giants of this order of insects, occupying one extremity of the scale. At the opposite extremity may be placed some species of the genera Trichopteryx, Atomaria, and Agathidium, which are so minute as not to exceed one-eighth part of a line in length;* or, to adopt an illustration sometimes employed, they are absolutely not bigger than the full stop that closes this period.

The structure of these minute beings is perhaps even more calculated to excite our admiration than that of the larger animals. In the latter, most of the parts are of sufficient size to come within the direct cognisance of our senses, and there is no apparent discrepancy between their dimensions and the functions which they perform; but when we reflect that a mere animated point, almost invisible to the naked eye, possesses all the attributes which belong to the largest of its race—that it is furnished with an external covering made up of many parts adjusted to each other with the nicest accuracy—that it is supplied with all the requisite organs of

* A line is the twelfth part of a French inch.

sense and motion, and has a nervous and respiratory system of greater complexity than many of the larger animals—that the various processes of digestion, assimilation, and secretion, are continually going forward—that not a limb can be put in motion without calling into play a multitude of muscles—and that this atomic being is moreover endowed with instincts which regulate with almost unerring certainty all its habits and economy—we can scarcely fail to regard it as affording a more striking instance of consummate skill than if it had occupied a much larger space.

> The shapely limb, and lubricated joint,
> Within the small dimensions of a point,
> Muscle and nerve miraculously spun,
> His mighty work, who speaks and it is done;
> The invisible in things scarce seen revealed,
> To whom an atom is an ample field.

"To the eye of the naturalist," says Latreille, "the mass or volume of an object is a matter of little consequence. The wisdom of the CREATOR never appears more conspicuous than in the structure of those minute beings which seem to conceal themselves from observation; and Almighty Power is never more strikingly exhibited than in the concentration of organs in such an atom. In giving life to this atom, and constructing in dimensions so minute so many organs susceptible of different sensations, my admiration of the Supreme Intelligence is much more heightened than by the con-

templation of the structure of the most gigantic animals."

If superiority in certain qualities must be conceded to some other tribes of insects, the Coleoptera certainly surpass them all, as well as the higher races of animals, in variety of form and singularity of structure. Among butterflies, the *Hymenoptera*, and two-winged flies, nearly as great a uniformity of outline prevails as in the case of birds and serpents. But there appears to be no general type of form according to which beetles have been modelled. They differ as widely among themselves in outward appearance, as separate classes of other animated beings do from each other. Even the great deep, which has ever been regarded as the fertile mother of all monstrous and all prodigious things, seldom produces an "odd fish" equal in eccentricity to some species of beetles. If we are less struck with the strange proportion of their parts, than with any unusual figure among the larger animals, it is on account of their small size, which is generally too inconsiderable to arrest our attention, and leads us to consider them in a great measure abstractedly from the idea of physical power with which we are accustomed to regard animated beings of large dimensions. But for this circumstance, they would excite the astonishment of the most careless observer, and lead us to fear lest they should realize the anticipations of the poet,—

Their shape would make them, had they bulk and size,
More hideous foes than fancy can devise;

With helmet-heads, and dragon-scales adorned,
The mighty myriads, now securely scorned,
Would mock the majesty of man's high birth,
Despise his bulwarks, and unpeople earth.

To those who have never had an opportunity of inspecting a well-stored cabinet of Coleoptera, or whose attention has never been drawn to the observance of the living insects in their native haunts, it is not easy to convey an adequate conception of the variety of forms which they assume. An examination of the accompanying plates will afford a more satisfactory notion of this than can easily be conveyed by description. The most common figure of the outline of the body is oblong or oval; frequently it is cylindrical or linear, that is, having the sides parallel with each other, sometimes orbicular, and occasionally almost square. These may be regarded as the primary or dominating forms, but they are subject to an endless variety of modifications, and are variously blended with each other. The surface is commonly convex, and the under side rather flat, so that a transverse section forms a segment of a circle; sometimes, however, the upper side is depressed, and the under side somewhat convex. The length of the body usually exceeds the breadth, but in some instances the transverse diameter is longest. The surface is frequently rendered unequal by numerous elevations and depressions, which cause the creatures "to resemble so many pigmy Altases bearing on their backs a mi-

crocosm, and presenting to the eye of the beholder no unapt imitation of the unequal surface of the earth, now horrid with mis-shapen rocks, ridges, and precipices, now swelling into hills and mountains, and now sinking into valleys, glens, and caves."* But the singular appearance of the greater number is produced by the horrid array of horns, spines, and other projections with which they are furnished. Some of these appendages are so remarkable as to be wholly unparalleled in any other department of the animal kingdom, and we are often wholly at a loss to conjecture what purposes they were intended to serve. In some instances (*Scarabæus Syphax*, and several allied species) three pointed horns, nearly half the length of the body, project forwards from the thorax, one on each side, and the other just over the head. Another species of large size (*Scarabæus Actæon*) has a long and powerful horn issuing from its head, curved backwards, and bifid at the point, and having a strong tooth on its upper side towards the base, while two other horns stand out from the thorax, one on each side. A middle-sized species, of a uniform reddish-brown colour (*Scarabæus claviger*), bears on the centre of its thorax a long stout horn, which is dilated in an angular manner at the tip, and curved forwards so as nearly to meet another of a slender subulate form arising from the crown

* Introduction to Entomology, by the Rev. William Kirby and William Spence, Esq. vol. i.

of the head. One group (*Lucanidæ*) is distinguished by the portentous length of their jaws, garnished with a formidable armature of angular projections and pointed teeth, bearing some resemblance to the branching antlers of some kinds of deer, on which account they have been named Stag-beetles. A second (*Eusceles* of Macleay) is so remarkable for the disproportionate length and thickness of the hinder legs, that it has been regarded as the representative of a quadruped of similar peculiarity of structure, and has therefore obtained the name of Kanguroo beetle. In an extensive section (*Longicornes*), of which many of the species are noted for elegance of form and agreeable markings, the antennæ are of such extraordinary length as to equal in some instances four times that of the body; and they are now and then singularly adorned with fascicles or tufts of long hair. Certain kinds, distributed throughout several different genera, and usually designated by the specific term *longimanus*, are furnished with anterior legs of unusual length, greatly exceeding, in relation to the size of the body, those of the Grallatores, or wading birds, and imparting a very grotesque aspect by their strange disproportion. Examples of similar anomalies everywhere present themselves in this Protean race of animals; but these will suffice to show that

> ——————— Nature here
> Wantons as in her prime, and plays at will
> Her virgin fancies.

The purposes which some of these peculiarities of structure were designed to serve are sufficiently apparent; but in the greater number of cases we can scarcely form a conjecture as to their use. Much of the variety of form which these insects present, is no doubt the necessary result of their being destined to subserve so many different purposes in the economy of nature. The configuration of each individual species is that which adapts it best to fulfil the various ends of its being; and this connection between figure and function is so strikingly displayed in the case of many insects with which we are well acquainted, that we are authorized to presume its existence when their habits are unknown to us. A more intimate acquaintance with these habits, would doubtless explain the utility of many a remarkable form and fantastical assemblage of horns and prominences, which our present imperfect knowledge might lead us to regard as unnecessary or even cumbrous, and would enable us to appreciate more fully the wisdom— "wonderful in counsel and excellent in working"— that has presided over the organization of these lowly beings, and taught them to work its will. At the same time it may reasonably be supposed that usefulness to the individual is not always the object in view: the production of a pleasing variety may have been as much the design of the creating mind in the present instance, as it appears to have been in giving a particular form and character to the leaves and foliage of different trees, although the functions

of many of these might, for aught we know, have been equally well performed had there been no such marked dissimilarity.

The colouring and variegation of coleopterous insects are not less remarkable than their forms. In the variety and beauty of their hues, they seem to combine the clearness and decision of tint possessed by flowers, with the diversified markings of the feathered race, and the metallic splendour of the mineral kingdom. "In this tribe," says an author, determined that his language shall not fall short of his subject, "lavish nature sports gorgeously in the mingled riches of indescribably refulgent colours, proof against a continuance of the visual ray, which makes the eyelids dance, while the optic nerve aches at the splendour."* "Nature in her sportive mood," say Messrs Kirby and Spence, speaking, it is true, of insects in general, but all their observations apply to beetles, "when painting them, sometimes imitates the clouds of heaven; at others, the meandering course of the rivers of the earth, or the undulations of their waters: many are veined like beautiful marbles; others have the semblance of a robe of the finest net-work thrown over them: some she blazons with heraldic insignia, giving them to bear in fields sable—azure—vert—gules—argent and or, fesses—bars—bends—crosses—crescents—stars, and even ani-

* Barbut's Gen. of Insects, p. 46.

mals.* On many, taking her rule and compasses, she draws with precision mathematical figures; points, lines, angles, triangles,† squares, and circles." Some extensive groups are characterized by the prevalence of certain hues, bestowed on them probably as a means of concealment from enemies, by assimilating them to the objects by which they are usually surrounded, or in subserviency to some particular purpose in their economy. The prevailing colour among beetles of obscure haunts—such as burrow in the earth, or pass the greater part of their lives under stones (the *Geodephagi* of some modern systematic writers), as well as those destined to facilitate the decomposition and dispersion of putrescent and excrementitious substances—is black or brown. The water-beetles (*Dytiscidæ*) are almost uniformly brownish black, inclining to olive, and frequently variegated with streaks and spots of dull yellow. The rostrated beetles, or weevils (*Curculionidæ*), present some of the most highly adorned examples of insect life; and in them also a curious instance is observable of change in colour accompanying dissimilarity of habit. Numerous kinds of these insects occur among loose earth and sand, or under stones, and these are almost invariably of sombre hues, and destitute of ornament: an extensive division of the same tribe inhabit trees and shrubs, and they are remarkable for displaying the

* *Ptinus imperialis*, Linn. † *Trichius delta*, Fab.

most vivid tints of green. As examples of this, the British genera *Otiorhynchus* and *Phyllobius* may be cited, and the foreign ones *Brachycerus* and *Entimus*. The elegant tribe of *Cetonidæ*, which find their sustenance on plants, and which are represented in this country by the Rose-chafer (*Cetonia aurata*), an avant-courrier of those "flying gems" that delight the eyes of the Entomologist in his progress southward—are generally of a fine green, often accompanied with a delicate schiller or play of colour, resembling the floating light on the surface of some precious stones; and they are sometimes spotted, or variegated with lines and bands contrasting strongly with the rest of the body. The *Chrysomelidæ*—a term which signifies an apple of gold—are most commonly of a pretty uniform golden-green, highly polished and lustrous, and streaked occasionally along the back with parallel lines of purple and blue; while the *Coccinellidæ*, or Lady-birds, are never distinguished by metallic splendour, but are prettily marked with round spots of black on a red or yellow ground, or with red spots on a ground of black.

The species in which some of these fine colours are combined with a high degree of lustre, and diversified markings, must evidently be objects of no mean beauty. An eye accustomed to the brilliant shades of green and purple that adorn many of the Buprestidæ—the blue and coppery hues of the Eumolpi—the varied delineations of the Cetonidæ—and the warm but delicate tinting of the Ceramby-

cidæ—will not frequently find other natural productions on which it can repose with greater pleasure. Such indeed is the splendour of some kinds, that the wing-cases and other parts are often worn as ornaments instead of precious stones. "A peculiar and scarce night-fly," says a writer on Japan, speaking of a species of beetle, "is of such incomparable beauty that it is kept by the ladies among their curiosities, and has given rise to the following fable: They say that all the other night-flies, owing to the unparalleled beauty of this little creature, fall in love with it, and in order to get rid of their importunities, it maliciously bids them (for a trial of their constancy) to go and fetch fire. The blind lovers scruple not to obey commands, and flying to the next fire or candle, they never fail to burn themselves."* Notwithstanding the beauty which many tropical species retain when brought to this country, and even after they have been preserved for many years in our cabinets, it cannot be supposed to equal that of their living state. In that condition only can there be a full development of their finer and more evanescent shades of colour—while their polished surfaces must be of dazzling brilliancy when seen under the light of a tropical sun, in angles continually varying with the motion of the animals, which are thus rendered no unfit associates of the Lories, Creepers, and other "birds of gorgeous plu-

* Kempfer's History of Japan.

mery," which people the gay parterres of a tropical landscape, and embellish them

> With their rich restless wings, that gleam
> Variously in the crimson beam
> Of the warm west—as if inlaid
> With brilliants from the mine, or made
> Of rainbows.

These insects occur in almost every country capable of supporting animal life. Even the ungenial sun of Greenland and Iceland awakes to a short and precarious existence a few small species, which endure, or rather escape from, the rigours of an arctic winter, by a kind of hybernation partly analogous to that of some vertebral animals. In the higher latitudes, however, of Melville Island and Winter Harbour, no coleopterous insect has been observed; and even the pestilent mosquito, which spreads over almost the entire surface of the habitable globe, extracting its nutriment equally from the tropical Indian and the greasy hide of the Laplander, appears unable to encounter the icy atmosphere of these hyperborean lands. It may indeed excite surprise that creatures of so fragile a nature should be found at all in such countries as those just mentioned; but it must be borne in mind, that they not only pass certain periods in the pupa or torpid state, but are usually, while in that condition, deeply buried in the earth. "What they chiefly require," Mr Macleay observes, "is the presence of heat during some period of their existence; and the

greater, within certain limits, is the heat, the more active will be their vital principle. On the American continent, the extremes of heat and cold in the course of the year are, as is well known, incomparably greater than in places of the same latitude in Europe. We may therefore readily conceive how particular families of insects will inhabit a wider range of latitude in the former country than in the latter. We also see how insects may swarm in the very coldest climates, such as Lapland and Spitzbergen, where the short summer can boast of extraordinary rises in the thermometer; because the energy of the vital principle in such animals is, within certain limits, proportionate to the degree of warmth to which they may be subjected, and escapes in a manner the severe action of cold."*

As heat is the principal agent in giving impulse and vigour to organic life, it will be found that these insects undergo as great a change under the increasing temperature of the earth and atmosphere on approaching the equator, as is well known to take place in vegetables and the larger animals. Their numbers are prodigiously augmented, and they acquire considerable momentum from the great size of many of the species. The latter, too, are continually varying even under the same parallel of latitude, so that countries similar to each other in soil, temperature, and all other circumstances which

* Horæ Entomologicæ, part i. p. 45.

might be supposed to have an influence on animals, present the most striking differences in their insect productions. Latreille has observed that the countries most fruitful in insects, are those in which vegetation is richest and most speedily renewed. South America, which is so prolific in

> —— all rare and beauteous things that fly
> Through the pure element,

furnishes a greater number of Coleoptera than any other country. It comprehends every variety of soil and climate, and offers all the other conditions that tend to the increase of organized beings. Its intertropical regions are watered by many sea-like rivers, and clothed with a luxuriance of vegetation scarcely equalled elsewhere; its mountain ranges, rising far above the limit of perpetual snow, are the sources of endless variation in climate and temperature; its elevated plateaus enjoy the temperate air of a northern latitude, while the climates of Spain, Italy, and France, and even of Norway and Sweden, are successively presented to us in our progress towards the Straits of Magalhaens. Extensive wastes of arid sand likewise occur, similar to those that cover so large a portion of the African continent; and the *Pampas* or *Llanos* (levels) stretching in a dead flat, like the illimitable expanse of the ocean, over an extent of country equal to a fourth part of Europe, and so far removed, in their untrodden solitudes, from the turmoil of ordinary scenes, that by the earliest European visitors they were styled,

in the play of imagination, *the regions of supreme repose*—form a feature in the physiognomy of the country peculiar to this continent. "Forests, the growth of thousands of years," says Humboldt in his "Tableau de la Nature," "of an impenetrable thickness, fill the humid country situate between the Oronoco and the Amazons. Immense masses of lead-coloured granite narrow the foamy beds of the rivers. The mountains and woods resound unceasingly with the roar of cataracts, the growl of the jaguar, or the dull howl of the red monkey, which foretells the approach of rain. In those places where the lowness of the waters leaves a sandy beach uncovered, with open mouth, but motionless as a rock, lies a crocodile, whose scaly body is covered with birds. The tiger-marked boa, his tail fixed to the trunk of a tree, his body rolled upon itself, sure of his prey, lies in ambush on the bank; suddenly he uncoils to seize the young bull which is just passing."

Brazil has always been regarded as the most fertile region of South America, and that portion of it lying between the twelfth and twenty-fifth degrees of south latitude may be considered the richest in the world in Coleoptera. Mexico perhaps is next to it, for that country is much more prolific than Guiana, so often referred to by the older Entomologists, who became acquainted with its productions through the early French and Dutch settlers, who have always been zealous collectors and culti-

vators of natural history. In the old world, the countries that afford the greatest number of these insects, are certain regions on the western coast of Africa, the Cape of Good Hope, Java, and the other large islands of the Indian Archipelago. New Holland possesses many remarkable kinds, and the island of Madagascar offers a rich and almost unexplored field to the industry of some future collector.

Some interesting sketches of the entomological aspect of Brazil, and other intertropical regions of America, are given by a recent French writer. According to his account, the insects of these countries in a great measure disappear during the months of May, June, July, and August, probably because that is the dry season, when vegetation is comparatively scorched and sapless, and therefore yields imperfect nourishment. But towards the middle of September, when the first showers begin to fall, all nature seems to issue from its repose. Vegetation acquires a tint of livelier green, the greater number of plants renew their leaves, and insects begin to appear. In October the rains become more frequent, and insects are seen in greater numbers; but it is not till the middle of that month, when the rainy season definitely sets in, that all the families seem, as it were, to undergo a sudden development; and this general impulsion, which all nature receives, goes on increasing till the middle of January, when it reaches its greatest height. The forests then present a scene of life and motion, of which our European woods can give

no idea. During one part of the day nothing is heard but a loud and uninterrupted rustling or humming noise, in which the harsh and deafening notes of the Cicadæ predominate.* One cannot move a step nor touch a leaf without seeing insects take flight from all quarters. The herbaceous plants are literally covered with brilliant beetles; and the slender twigs of the *mimosa*, on which they live in society, appear to bend under the weight of diamond-beetles (*Entimus imperialis* and *nobilis*). This teeming exuberance is most striking in the morning, before the sun has evaporated the dews of the night. Towards the approach of mid-day the heat becomes insupportable, and all animated nature sinks into repose. The din ceases, and insects, as well as other animals, seek the freshness of the shade, from which they do not again emerge till the approach of night has cooled the thirsty air. To the species of the morning then succeed a multitude of others, many of which, and these too of the largest and most remarkable kinds, are seldom observed but in the evening twilight. Then also

> —— the night-eyed insect tribes
> Wake to their portion of the circling hours.

* "Captain Hancock informs me that the Brazilian Cicadæ sing so loud as to be heard to the distance of a mile. This is as if a man of ordinary stature, supposing his powers of voice increased in the ratio of his size, could be heard all over the world. So that Stentor himself becomes a mute when compared with these insects."—*Kirby and Spence's Intro. to Entom.* ii. 404.

The *Lampyridæ*, issuing in myriads from their retreats, diffuse their mild effulgence over the plants and shrubs, which they often cover with their numbers; and the luminous *Elateridæ* dart about in all directions, filling the air with their radiant tracks. This natural illumination does not cease till the approach of day.

Although these insects, as has been stated, generally increase in number as we proceed from the poles to the equator, yet there are some exceptions to this rule. Among these are the aquatic beetles (*Dytiscidæ*), which are most numerous in the temperate zone, and also of larger size than within the tropics. At the same time there is scarcely any tribe of Coleoptera more widely distributed than this; a circumstance no doubt attributable to the equable temperature of the medium in which they live, which exempts them in a great degree from the modifying influence of climate. Of this a familiar proof is afforded by our native *Colymbetes*, which continue pretty active throughout the winter, when other insects are in a state of torpidity. We have occasionally seen them swimming with alacrity in the waters of a pond when the surface was covered with a thick coating of ice. The same circumstance that accounts for their extensive diffusion, may therefore be regarded as the cause of their not increasing in tropical regions. In the latter countries, besides, every pool or stagnant water, such as these creatures love to frequent, is dried up during one

season of the year by a rapid evaporation, and the smaller streams at one time undergo the same fate, and at another assume the character of torrents.

As providence in the creation of insects seems partly to have designed them for removing various nuisances and superfluous materials from the face of nature, their distribution is regulated accordingly, and their numbers proportioned to the work assigned to them. In temperate climates, for example, where the dead carcasses of animals decompose but slowly, our senses would be continually offended, and our health liable to injury, from the unwholesome miasmata that exhales from them, unless some provision were made to accelerate their removal. We accordingly find a profusion of carcass-eating beetles —*Necrophori*, *Silphidæ*, &c.—which speedily assemble from all quarters, round a dead body, led by the emanation of the tainted air, and in a short period it is either buried or consumed. In several extensive countries of South America, however, where the extreme dryness of the air and heat of the sun cause the animal juices to evaporate with such rapidity that a dead body can scarcely be said to putrefy, but is converted into a substance so completely desiccated, that travellers across the woodless pampas sometimes make their fire of a dead horse, such insects would scarcely be required, and accordingly few if any have been observed. In this country, and others under similar latitudes, nature has devolved the task of removing excrementitious

nuisances chiefly on a numerous host of small beetles belonging to the genera *Aphodius, Onthophagus, Aleochara,* &c. Some kinds (such as the *Geotrupidæ*) convey the dung to the bottom of holes dug to receive it, and make it a receptacle for their eggs; others consume it, and by perforating the mass in all directions, make it pervious to the air and wind, by which it is soon dried and scattered, leaving the herbage on which it rested to spring with renewed vigour. In warmer countries, where the task becomes more onerous, from the increased number of large mammiferous animals, the species mentioned are superseded or assisted by others more powerfully gifted, such as the gigantic Scarabæi, the Phanæi, and Ateuchi, whose singular habits we shall afterwards describe. New Holland, on the contrary, being destitute of large animals, furnishes scarcely any coprophagous insects, except a few scarce species, most of which are referable to a single genus.

As the different continents produce various kinds of the higher animals not occurring in other regions, they are in like manner distinguished by possessing peculiar species of insects. Many of these will be afterwards particularized. The geographical distribution of the Coleoptera is still so imperfectly understood, that the attempts which have been made to illustrate it consist not so much in an exposition of the general principles by which it is regulated, as in a detail of insulated facts and observations. These it will be more satisfactory to give hereafter,

as a part of the general history of particular groups and species; and we shall conclude these introductory observations by giving an account of the external organs of coleopterous insects, in order that the descriptions and generic characters in the subsequent part of the volume may be more readily understood.

The most characteristic feature of the coleopterous order, and from which it obtains its name, has been already mentioned, viz. the horny consistence of the upper pair of wings. The whole body is likewise covered with an integument or crust of a similar nature, more or less rigid, which has been found, on analysis, to consist chiefly of a peculiar principle named *chitine*. This corneous envelope defends the internal organs, and executes a function analogous to that of the bones in vertebrate animals, by supporting the softer parts, and affording points of attachment to the muscles.

It is one of the distinguishing attributes of the class of insects, that their bodies are *insected* or divided into many jointed parts, a mode of structure which is more or less obvious in all their different states of existence. These segments are more regular and distinct in the larvæ of the Coleoptera than after the insects have undergone their final transformation, by which some of the rings become very much enlarged, while others suffer a corresponding diminution. But in every perfect insect

there are three obvious divisions, consisting of the head, thorax, and abdomen.

The head appears as a single piece, without any obvious suture or division, and is generally of a harder substance than the rest of the body. Its form is most commonly triangular with the angles somewhat rounded, frequently it is orbicular, and in a numerous and important tribe (*Curculionidæ*) it is produced into an elongated rostrum or snout. The hinder part is occasionally constricted into a short neck, which inosculates in the anterior cavity of the thorax, and admits of a considerable degree of motion in almost every direction. The position of the head, or its inclination with respect to the body, is generally somewhat slanting, forming an angle more or less obtuse; but in some instances it is bent inwards and forms an acute angle. The anterior part of the head is occupied by the mouth and its various appendages, near to which are placed the antennæ and eyes.

The mouth is greatly more complicated in its structure than among the higher animals, and its various parts undergo numerous modifications in different tribes. They will be found however to be essentially as follows: the *labrum* or upper lip, the *mandibles*, the *maxillæ* or under jaws, the *labium* or under lip, and the *mentum*.

The upper lip (*labrum*) is a small moveable piece placed on the upper side of the mouth, and closing it from above. It is variable in form, but is most

commonly quadrate, usually wider than long, and sometimes rounded or triangular. It is of a horny consistence, and its direction is often somewhat slanting or vertical. Its outer margin is frequently sinuated or notched.

The mandibles, or upper jaws, are two strong horny pieces, which take their rise one from each side of the mouth, immediately beneath the upper lip, which usually covers their base. They are generally of a triangular form, more or less curved, especially towards the tip, and usually toothed or serrated on their inner edges. They may be said to represent the jaws in vertebrate animals, but they differ in this, that their motion, instead of being vertical, is horizontal or from side to side. Their internal surfaces are frequently parallel, but the dentations are seldom alike in both, the projections of the one being so arranged as to enter the concavities of the other, in order to admit of their closer junction. This, however, is often prevented by the curvature of the tips; and in several instances where the mouth is wide, and the mandibles rather remote from each other at the base, the blades cross each other a little beyond the centre. The name, which is derived from a Latin word signifying to chew, indicates their function, which is to bruise and comminute the food; and they likewise act as instruments of prehension. They are liable to remarkable variation in size; in many genera they are so short and inconspicuous as to be almost en-

tirely concealed within the cavity of the mouth, while in others they are nearly equal to half the length of the body. Instances of the latter may be seen in several of the species figured, particularly Prionus cervicornis (Plate XXIII.), Chiasognathus Chiloensis (Plate XVIII.), and the stag-beetle.

The under jaws (*maxillæ*) are likewise two projecting pieces, inserted on each side of the mouth, immediately below the mandibles. As in the last-named organs, their action is horizontal, but their texture is generally less rigid, their colour usually paler, and their internal edges ciliated or fringed with hairs. The tip is frequently acute, and in one beautiful tribe of beetles (*Cicindelidæ*) it terminates in a moveable claw; but in many instances the maxillæ are lobed, and of a spongy consistence at the extremity. As accessory to the mandibles, they are employed in holding the food, lacerating it, and subjecting it to a still further comminution, after the harder parts have been broken down by the more powerful action of the upper jaws.

Towards the middle of the outer edge of the maxillæ, there emerge two slender filiform processes, composed of several joints, named *palpi*. These are usually termed maxillary palpi, to distinguish them from another pair which take their origin in the under lip. In many beetles each jaw is furnished with two of these appendages, in which case they are distinguished from each other as the external and internal palpi; but in numerous instances

there is only one palpus attached to each blade of the maxillæ. These organs generally consist of four joints, of which the terminal one is remarkable for the variety of forms which it assumes in different insects, affording valuable characters for distinguishing genera. When an internal palpus is present, it is usually formed of two slender articulations. The palpi are susceptible of rapid and extended motion, and are sometimes observed in a state of intense vibration, similar to the antennæ of Ichneumons, and other Hymenoptera, when exploring a decayed trunk to discover a proper nidus for the reception of their eggs. They are supposed to constitute one of the principal organs of touch. That they perform this function is rendered extremely probable by their structure, which is well adapted, by its peculiar pliancy, to the examination of the objects with which they come in contact. The joints into which they are divided likewise favour this explanation of their use, since they seem to present some analogy to the articulated extremities which form the principal seat of the sense of touch in the higher animals. It is at the same time probable that these organs are subservient to other purposes.

As the mouth is covered above by the labrum or upper lip, so it is closed beneath by the under lip or *labium*. This part is situate between the maxillæ, and is composed, as it were, of two portions joined together by their inner edges. The part

immediately behind it, which may be considered as forming its base, is named the chin (*mentum*). This piece is usually transverse, or broader than long, and is in most instances sinuated or notched in the middle of its anterior edge, with an acute tooth in the centre of the notch, which is sometimes bifid. From each side of the labium, and frequently attached to its lateral margin, there projects an articulated feeler, similar to those borne by the maxillæ. These are called the labial palpi. They generally consist of three moveable articulations, attached to a fourth which is adherent and forms a support to the others. They seldom equal the external maxillary palpi in length, and the terminal joint does not exhibit such a variety of form, being most commonly somewhat clavate, or nearly of equal breadth throughout its whole length.

The most conspicuous appendages of the head are two jointed organs, which stand out like horns from the forehead, and are named *antennæ*. These never exceed two in number in genuine insects, and are situated anterior to and rather beneath the region of the eyes: occasionally they are placed close to the margin of the eyes, and in some instances the latter have a sinuosity for their reception, and partially encompass their base. They are generally composed of eleven obconical or tubular joints, liable to great variation in their relative proportions. Occasionally, however, the joints do not exceed

nine or ten, and in some cases, instead of being conical, they are globose and somewhat remote from each other, being connected by a slender filament, so that they bear no unapt resemblance to a series of beads rather loosely strung. The ordinary length may be stated to be about half that of the body, but they very often fall short of these dimensions, and in many insects they are not longer than the head. On the other hand, they often equal or surpass the length of the insect, and in the Capricorn-beetles, a tribe distinguished by the length and delicate structure of these members, they are sometimes more than four times as long as the body. Although of considerable importance in the systematic arrangement of insects, the development of the antennæ does not seem subjected to any very general or well-established rules, and is therefore of less value than certain other parts of structure. For example, we frequently find a considerable difference to exist in the form of the antennæ among species in other respects intimately allied; and even between the sexes of the same species a great disparity of size and structure is observable. When a difference exists, those of the male are more fully developed than those of the female.

The antennæ are obviously of the first importance in the economy of insects, but their primary use has not been fully ascertained. It seems to be generally admitted that in many tribes they exercise

a function analogous to that of touch, being employed in exploring the depth of crevices, and in ascertaining by contact the nature of any opposing object. But as their extreme shortness in two-winged flies (*Diptera*), and some other insects, does not accord with that usage, they are likewise supposed to be the seat of a particular sense. Proceeding on the assumption that all the organs of sensation found in the higher animals have their analogues in insects, some observers maintain that the antennæ represent the ears, and that although they may not directly convey the vibrations of sound to the sensorium, their primary function is something related to hearing. Others again suppose that they are the media through which the sense of smell is effected, but this explanation of their use is disproved by Huber's observations on Bees, which show that the sense of smell, at least in these hymenopterous species, is placed within the cavity of the mouth.

The appendages of the head and mouth which have just been described, are represented in their natural position by the following figures, which we have taken the liberty to copy from Griffith's edition of Cuvier's Animal Kingdom: *a* (fig. 1) is the labrum or upper lip; *b* the mandibles; *c* the external maxillary palpi; *d* the labial palpi; *e* the antennæ; *f* (fig. 2) the labium or under lip; *g* the mentum, with a triangular tooth in the centre of its notch; *h* the internal maxillary palpi; *i* the maxillæ, produced into an acute arcuate lobe.

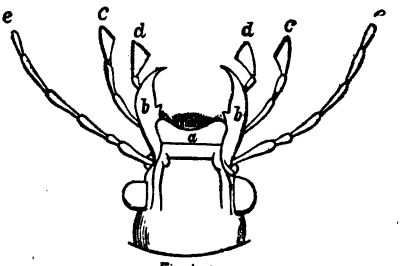


Fig. 1.

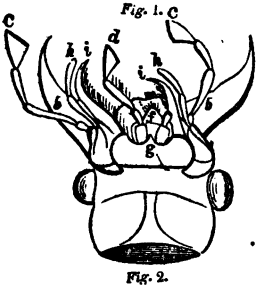


Fig. 2.

The next part of a coleopterous insect which requires some notice is the *thorax*, which it will suffice for our present purpose to describe as a single principal portion, intermediate between the head and abdomen. It is the seat of all the organs of motion, and is usually strong and muscular, as it forms the chief support of all the other parts of the body. It is generally wider than the head and narrower than the abdomen. The form of the upper and exposed portion is very variable: in an extensive tribe of beetles it is more or less heart-shaped,

truncated before and behind, with a longitudinal groove down the middle. In other instances it is somewhat square, and occasionally it is nearly orbicular. The inferior portion of the thorax is composed of a single piece named the *sternum*, or breast-bone. It is much developed in certain tribes, particularly water-beetles (*Dytiscidæ*), and in the beautiful species which constitute the genus Buprestis. Of the hinder portion of the thorax, the only part seen from above is a small piece, commonly of a triangular form, with its point projecting backwards and interposed between the suture of the elytra at the base. This piece is termed the *scutellum*. It exists in a more or less obvious form in nearly all beetles, and although usually minute, it is sometimes so large (as in the genus *Macraspis*) as to occupy a considerable portion of the dorsal area. The appendages of the thorax are the instruments of motion, the wings and legs, on which it is necessary to bestow a brief consideration.

The true organs of flight in the Coleoptera are two membranous and transparent wings, jointed upon the upper and hinder portion of the thorax. They are generally very ample, and are extended by means of a few strong nervures which run in a longitudinal direction, and throw off a few lateral branchlets. When in a state of repose they are transversely folded, and in most cases completely covered by the first or upper pair of wings. The latter, as has been already stated, are of a hard or

horny substance, similar to the crustaceous envelope of the head and thorax, and in the language of entomology are named *elytra* or wing-cases. These organs are likewise articulated to the thorax, and when at rest lie along the back of the abdomen, in the middle of which their internal edges meet and form a straight longitudinal line or suture. At this point of junction the wing-cases are sometimes soldered together, and form a single undivided piece, which completely incases the abdomen. In such instances the inferior wings are wanting, or exist in a very rudimentary condition, and the species are of course incapable of flight. The elytra usually cover the whole upper surface of the abdomen, which, being sufficiently protected by their means, is rather of a soft consistence; in numerous examples, however, they cover only a small portion at its base, in which case the exposed surface is equally rigid with the rest of the body. Without some protection similar to that afforded by the elytra, the inferior wings would be continually liable to injury, as they are but little adapted by their delicate texture to resist the attrition to which they are so often exposed by the haunts of the species, many of which live among loose earth and under stones. The wing-cases likewise serve to protect the stigmatic openings, placed along the sides of the abdomen, by which air is introduced for the purposes of respiration; and it is probable that they assist materially in the act of flight, by presenting a broad and con-

cave surface to the air, and maintaining the body in a proper equilibrium.

The aërial movements of these insects are not, however, in general performed with that power and ease of evolution which are so remarkable in birds, and even in certain other tribes of their own class. In the larger kinds especially, the weight of the body seems somewhat disproportionate to the size and motive apparatus of the wings, and their flight is therefore heavy and laborious, and seldom sustained for any considerable time. They rise into the air but slowly, and although their motion soon becomes rather rapid and headlong, the frequency with which they strike against any object that happens to come within the line of their flight, shows them to be incapable of exerting that degree of muscular energy necessary to check suddenly the impulse they have received, or speedily change its direction. It is probably owing to this cause that they are so often seen to come in contact with other objects, rather than deficiency of sight, to which it is ascribed in the saying, "blind as a beetle." Olivier asserts that no coleopterous insect can fly against the wind, and it is probable that the affirmation is correct, at least in relation to the majority, and when the wind is so high as to offer much resistance. Many of the smaller beetles, however, and those whose habits render a sustained flight necessary (such as the tree-chafers, *Melolonthæ*, &c.), possess considerable power of wing. During a warm day in spring the air is

filled with *Staphylinidæ*, *Sphæridiidæ*, and other minute beetles, which flit about in the sunshine with an ease and velocity which sufficiently indicate the perfect aptitude of their structure for such an exercise.

In beetles, as well as in all other insects properly so called, there are six legs, each of which may be considered as composed of four principal pieces, viz. the coxa or haunch *a*, the thigh *b*, the tibia or shank *c*, and the tarsus or foot *d*, as represented in the following figure.

The coxa may be regarded as the joint which connects the leg with the thorax. It is frequently furnished with an appendage called the *trochanter*. The thigh is the largest and most conspicuous portion of the leg; it is usually somewhat flattened, and frequently spined or serrated on the edges. In the jumping beetles (*Halticæ*), and some other species (as in *Sagra*, Plate XXVII.), the hinder thighs are very much thickened. The tibiæ are generally shorter and more slender than the thighs, growing thicker at the lower extremity, and having a tendency to a triangular form. They are frequently beset with stiff bristles, and armed more or less with spines or spurs. The tarsus is the terminal portion of the foot, and consists of small joints varying in number from five to three. The shape of

the joints is most commonly triangular or elongate-quadrate. On the under side they are usually densely clothed with hairs or bristles forming a kind of cushion, which enables the insects to make their footing more secure. The tarsi terminate in two curved claws, which in some instances are double, and in others are bifid at the tip. They are frequently serrated on the under side.

As the anterior pair of legs are in most cases convertible into organs of prehension, they sometimes exhibit striking peculiarities in their structure in order to adapt them to this usage. In several species they are remarkably elongated, and occasionally provided with a kind of hook at the extremity of the tibia, as in the harlequin beetle, represented on Plate XXV. In other instances, as among some of the predacious *Carabidæ*, the anterior tibiæ have a deep notch on the inner side towards the apex, above which there is placed a strong moveable spine, which admits of being pressed down across the opening, and thus secures any object that may happen to be within it. A scarce British beetle, found on the coast of Norfolk, and on the shores of the Frith of Forth near Portobello (*Cillenum laterale*), shows an arrangement of this kind; and it is rendered still more efficient by the addition of two small spines on the side of the notch opposite to the moveable spine, which receive the latter between them when it closes, and prevent it from being twisted in a lateral direction (fig. 1 of the

following cut). A similar structure is observable in the anterior legs of the common Blister-beetle; but in this instance the notch is in the basal joint of the tarsus, and is closed by a strong conical spine arising from the interior angle of the tibiæ (fig. 2). This apparatus is confined to the male, and, according to the observations of M. Victor Audouin, it is employed to lay hold of the antennæ of the female, which it effectually secures.

Fig. 1.

Fig. 2.

To answer a similar purpose, the tarsi of many male carabideous insects are considerably dilated, and clothed with hair in such a manner that they act as suckers. In the males of the large water-beetles especially, (genus *Dytiscus*), there is a singular and elaborate apparatus of this kind, the examination of which, to use the words of Messrs Kirby and Spence, will almost compel the most inattentive observer to glorify the wisdom and skill of the ALL-FATHER, so conspicuously manifested in the formation of these complex organs. The three first joints

of the anterior tarsi are dilated so as to form a circular plate, fringed round the edges with strong hairs; the under side of this plate is more or less thickly covered with small circular cups, some of which are placed on footstalks, and others are nearly sessile; two of the largest of these cups are situated near the base of the plate, the whole apparatus forming a powerful sucker. A very beautiful and curious appendage, designed probably to serve a similar end, has been noticed on the under side of the tarsi of a dark-brown beetle (*Harpalus ruficornis*), found everywhere throughout Britain, under stones and among rubbish.

The third and last primary division of the body is the abdomen, an important portion of the animal economy. It is generally the largest part of the insect, and is closely attached to the hinder extremity of the thorax. It is unprovided with locomotive organs, and is composed of rings or segments, on both sides of which are placed rounded openings, named stigmata, or breathing holes, through which the fluids become aërated. Many Coleoptera have a tubular retractile piece at the extremity, termed an ovipositor, which forms a funnel for conveying the eggs in safety to their appointed nidus; but no insect in this order is possessed of any appendage analogous to a sting. The abdomen is generally larger in the females than in the opposite sex, and differs in the form of the terminal segments, besides having one fewer than the males.—We now proceed

to give a historical and descriptive account of the leading groups and most remarkable species belonging to this extensive and important tribe of insects.

The first division of the Coleoptera includes all the kinds which have five joints in each tarsus, on which account it is named

PENTAMERA,

a term derived from two Greek words, πεντα, *five*, and μερος, *a part* or *joint*.

The species which most systematic writers place at the head of the coleopterous order, constituted the Linnæan genus CICINDELA, a term which was anciently applied to various destructive insects, as well as to those possessing luminous properties. This precedence is assigned to them owing to a certain perfection and development of structure, by which they are fitted for a mode of life pre-eminently carnivorous. The legs are long and slender to enable them to pursue their prey with rapidity, the eyes globose and remarkably prominent, and all the organs employed for the purposes of prehension and mastication of the most efficient kind. Of these the mandibles are most conspicuous, as they project from the head, and are garnished with long and powerful teeth. The same circumstance is observable in these

creatures that has been sometimes noticed in the higher animals, that the most blood-thirsty propensities are often combined with elegance of form and the highest beauty of colouring. They are adorned with the most beautiful tints of green and blue, with coppery or golden reflections, and the majority are variegated with spots and streaks of yellow. Their rapacity and agile movements have procured for them the name of Tiger-beetles. They prey indiscriminately on other insects, and few of the smaller kinds are capable of eluding or resisting their attack.

The larvæ are equally voracious with the perfect insect, but their locomotive organs being too imperfect to enable them to attempt an open war, they have recourse to stratagem. In that early condition the body is long, white, and cylindrical, furnished with six scaly feet of a brown colour, and having two strong fleshy tubercles, like horns, rising from the back. It is entirely of a soft consistence, except the head, which is covered with a large rounded plate, and armed with two large jaws. These grubs dig cylindrical holes in the sandy soil where they love to reside, and lie in ambush at the entrance, the opening of which is completely closed by the broad scaly head. As the excavation is nearly perpendicular at its mouth, the grub would have difficulty in retaining its position, were it not for the dorsal spines formerly mentioned, by which it suspends itself to the side of its dwelling. When lying in wait in this position, the jaws are expanded, and

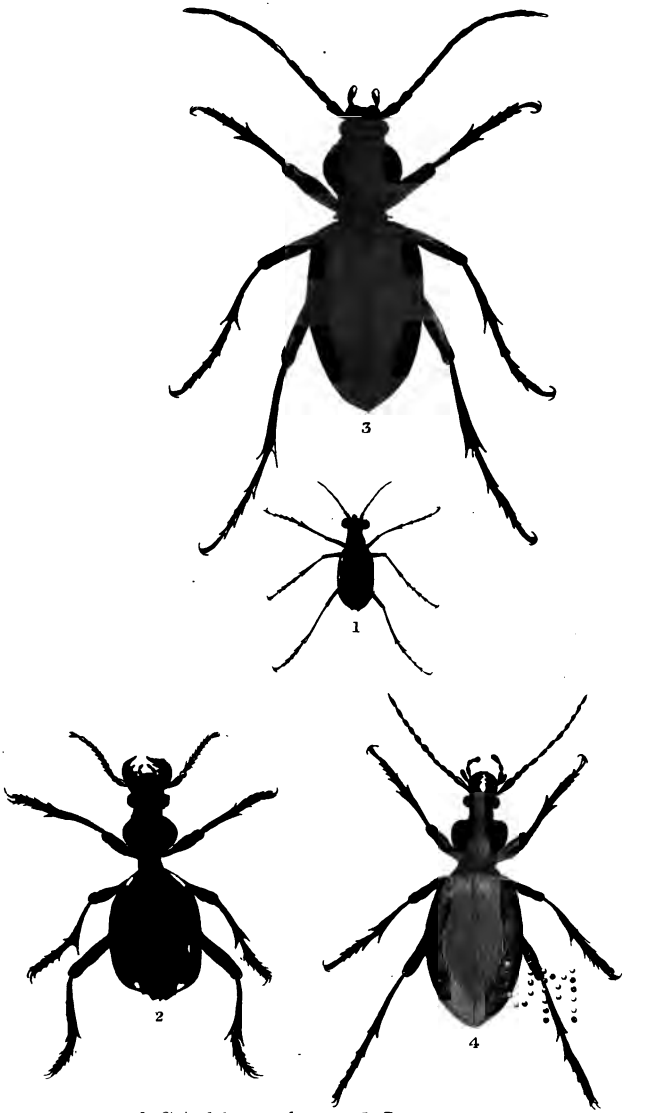
ready to seize any unwary insect that comes within reach; sometimes it makes a sudden dart if the object is at some distance, and immediately retreats to the interior of its den. Their voracity is not satisfied with other insects, but extends to their own species; and when two individuals form their holes in the immediate neighbourhood of each other, the stronger devours the weaker, that there may be no interference with his own pursuits. When about to change their skins or be converted into nymphs, they retire to the bottom of their holes, having previously sealed up the entrance.

The perfect insects are found in the spring and summer months, usually in sandy fields exposed to the sun. They seem rather partial to heaths, and certain kinds are found only in the vicinity of the sea.

In its present restricted form the genus contains upwards of 200 species, only six or seven of which occur in Britain. The most common throughout the northern parts of Europe is *C. campestris*, one of the most beautiful of our indigenous insects. It is of a fine green colour, glossed with coppery-red, and having five yellowish spots on the margin of each elytron, and another towards the middle. It is distributed over the whole island, but is rather local in Scotland.

A beautiful species representing this genus is the

PLATE 1.



1. *Cicindela aurulenta.* 3. *Procerus Taurieus.*
2. *Anthia decemguttata.* 4 *Carabus hispanus.*

Lizars sc

CICINDELA AURULENTA.

PLATE I. Fig. 1.

Fabricius, Syst. Eleuth. p. 239, No. 38.—*Dejean, Spec. Génér.* vol. i. p. 46.

The ordinary length of this insect is about seven lines and a half. The upper lip, which projects very little, is yellow, somewhat dusky at the base and sides. The mandibles are deep black, and marked with a yellowish spot at the base. The palpi and four lowest joints of the antennæ are greenish bronze, occasionally changing into blue; the remaining joints of the latter are dull black. The head is striated between the eyes, that is, marked with slightly impressed longitudinal lines, and of a fine green colour variegated with blue. The thorax is narrow, greenish blue, with two large patches of golden green. The elytra are duller than the other parts of the body, the colour bluish green, glossed with golde yellow at the base and margins, and each marked with four spots of yellowish white, of which that next the shoulder is very minute, and the third somewhat crescent-shaped. The under side of the body and legs are variegated with blue and green, and of a very brilliant lustre. This species inhabits Java, and other Asiatic islands. It likewise occurs in China; and the individual figured was found so far to the west as the British possessions in India.

The tribe which next presents itself to our notice is of very great extent, including a vast assemblage of species which differ considerably from each other in appearance and habit. They are named CARABICI by modern authors,—a term which corresponds to the old and comprehensive genus Carabus of Linné. They are readily distinguished from the preceding tribe by the structure of the lower jaws, which terminate simply in a hook without any articulation. The form of the typical or characteristic kinds is handsome; and although the prevailing hue is obscure, not a few of them are ornamented with colours of great brilliancy. The head is usually somewhat triangular, and borne horizontally or slightly inclined; the thorax more or less heart-shaped and truncated, with a longitudinal impressed line in the middle; and the abdomen is long and oval, having a considerable degree of convexity both above and below. The legs are generally long and powerful, and most of the species run with great rapidity; but few of them fly well, and no inconsiderable number are entirely destitute of wings. The organs of the mouth are very fully developed, demonstrating a decidedly carnivorous disposition; but the mandibles are never furnished with such prominent teeth as those of the Tiger-beetles.

Many of these insects are characterized by having the hinder extremity of the elytra truncated or cut across; and they seldom completely cover the abdomen, but leave a small portion of its apex exposed.

Such as exhibit a formation of this kind constitute the section TRUNCATIPENNES. Some of the species have attracted much attention in consequence of a very singular means they employ to repel the attacks of their assailants. The majority of carabideous insects secrete an acrid and caustic fluid, which, when irritated, they discharge with considerable force. But in the kinds alluded to (belonging chiefly to the genus *Brachinus*), the fluid is so volatile, that when it is propelled by the insect it immediately evaporates with a detonating sound, so that the discharge seems to consist of blue smoke, which is of a peculiarly disagreeable and penetrating odour. These bombardiers, as they are named by the French, can fire a considerable number of volleys before their ammunition is exhausted. The largest kinds inhabit tropical and other warm countries; but a few extend pretty far to the north, there being several indigenous to France and the south of England.

To the section with truncated elytra belongs also the genus ANTHIA (a name originally applied by Aristotle to a kind of fish), which, however, does not well exemplify the distinctive feature of this subdivision, as the elytra are sinuated rather than truncated at the extremity. It is known by having the terminal joint of the external palpi somewhat cylindrical and truncated, or in the shape of a reversed cone; by the want of a tooth in the notch of the mentum; and by the elongate-ovate form of

the elytra. The species are confined to certain districts of Asia, and the African continent. Even the southern shores of Europe, of which the vegetable and animal productions become strongly assimilated to those of Africa, have not hitherto afforded any examples. They delight in an arid and sandy soil, in which they form shallow excavations, and lie in wait for their prey. In manners, and even in the figure of their bodies, they bear a greater resemblance to the beetle named *Broscus cephalotes*, found abundantly on the sandy shores of the sea in many places both in England and Scotland, than to any other British insect. They partake of the form which prevails among beetles accustomed to burrow in the soil, and which is best exemplified in the Scarites and Clivinæ, or mole-beetles, as they are sometimes called, which live chiefly beneath the ground. The head is very thick and strong, fitted to make its way through a resisting medium, and the thorax is attached to the abdomen by a narrow neck-like portion, which admits of the anterior part of the body being easily turned in a lateral direction, and therefore answers the same purposes as the flexibility of the vertebral column in moles and other burrowing quadrupeds. The hinder part of the body is considerably wider than the anterior, a circumstance never observed in burrowing beetles properly so called, as it would materially impede the insect's progress through its cylindrical excavations. The species figured is

ANTHIA DECEMGUTTATA.

PLATE I. Fig. 2.

Fabricius, Syst. Eleuth. p. 221.—Carabus decemguttatus, *Oliv.* iii. 35, pl. 23, No. 16.

The general colour of this species is dull black. The eyes are brown, and the antennæ incline to the same colour, but the four lowest joints are more or less thickly covered with whitish down on the under side. On each side of the thorax anteriorly there is a small white spot. The elytra are marked with a few deep grooves, which are pretty densely clothed with whitish down; this, however, is frequently rubbed off, and in the bottom of each groove there appear two rows of small impressed points, and a longitudinal ridge between them. Each elytron has five spots of white down, but some of these are often obliterated (as in the example figured). The under side of the body and legs are of a more shining black than the other parts, and the thighs are sometimes brown.

This insect varies greatly in size, colour, and even in the relative proportion of its parts, and it has in consequence been described under several different names. It is found in the neighbourhood of the Cape of Good Hope, where it appears to be very common.

The genus CARABUS properly so called is distinguished by having the upper lip simply notched or

bilobed, by the tooth in the middle of the mentum being entire at its apex, and by the joints of the anterior tarsi being dilated in the males. The antennæ are nearly filiform, or become gradually somewhat more slender towards the outer extremity. The external palpi terminate in a joint considerably wider than the others, and forming a kind of triangle. The thorax is heart-shaped and truncated, the mandibles have a single tooth at their base, and the wings are not adapted for flight. In a few very large and remarkable European species the anterior tarsi have been found to present no appreciable difference in the two sexes, and these have accordingly been formed into a distinct genus under the name of PROCERUS. The latter are among the largest carabideous insects with which we are acquainted. They are of a uniform black colour on the under parts of the body, but tinged with green or blue above. They seem chiefly to inhabit the mountainous districts of the eastern and southern parts of Europe, the Caucasus, and Asia Minor. The species represented is

PROCERUS TAURICUS.

PLATE I. FIG. 3.

Carabus Tauricus, *Pallas.*—Carabus scabrosus, *Fisher, Entomographie de la Russie.*

This fine insect is little short of two inches in

length. The colour of the upper surface is a fine blue, inclining sometimes to green. The thorax is nearly twice the width of the head, truncated before and behind, and somewhat heart-shaped; the surface rough and granular. The elytra are oval and convex, covered with large tubercular points, which are arranged nearly in straight lines. The under side of the thorax and the sides of the abdomen are tinged with greenish blue; the other parts, as well as the legs, are black.

The insects to which the generic appellation of CARABUS is now restricted is of very considerable extent, including about 170 well-ascertained species. They are generally of considerable size, and most frequently of a dark colour, glossed with blue or purple. Many of them, however, are of the brightest metallic hues, and deserving of being ranked among the most ornamental of European beetles. Such are *C. rutilans*, an inhabitant of the Pyrenees, and our own *C. nitens*, found in heathy districts, where the soil is formed of peat, in many parts of Scotland and the north of England, which scarcely yields to any exotic insect in the brilliancy of its lustre. The principal seat of the Carabi is within the temperate zones; they become rare in very warm countries, and seem to disappear altogether within the tropics. They are most abundant in the old world, but a few have likewise been observed in the northern and southern extremities of America. Britain possesses about sixteen species, and

half that number has been ascertained to inhabit Scotland.

CARABUS HISPANUS.

PLATE I. FIG. 4.

Fabricius, Syst. Eleuth. p. 171.—*Olivier*, iii. 35, p. 22, No. 14, pl. 1, fig. 9.

This species varies in length from ten to fifteen lines. The surface of the head is of a fine blue inclining to violet, with the anterior part black; it is rather deeply punctured, and marked with irregular wrinkles. The antennæ are black, and the eyes brown. The thorax is nearly heart-shaped, a good deal contracted behind, similar in colour to the head, and likewise rough with punctures and wrinkles: there is also an impressed line down the centre. The scutellum is black. The elytra are of an elongate-oval form, covered with impressed points which have a tendency to run into lines, three of which are pretty distinctly formed: they are of a bright copper-colour, glossed on the exterior edges with violet, and having a very high degree of lustre. The under parts of the body and the legs are glossy black.

This splendid insect occurs in mountainous districts in the south of France, usually frequenting the banks of small rivulets which flow down the sides of hills.

PLATE 2.

1. *Carabus auratus.* 2. *Carabus clathratus.*
3. *Tefflus Megerlei.*

Lizars sc.

CARABUS AURATUS.

PLATE II. FIG. 1.

Fabricius, Syst. Eleuth. p. 175.—*Olivier*, iii. 35, p. 32, No. 30, pl. 51, fig. 5, *a*, *b*, *c*.—*Dejean, Spec. Génér.* p. 111.

The colour of the upper side is green, glossed with golden yellow. The head is faintly punctured, and there are two longitudinal impressions between the antennæ. The organs of the mouth, and the four lowest joints of the antennæ, are reddish. The thorax is marked like the head, and has a longitudinal line down the middle, and a transverse impression on each side near the posterior angles. The elytra are oval and convex, each of them with three elevated ridges, the spaces between which are covered with small raised points, making them appear somewhat granulated. The under parts of the body are black, the anterior part slightly tinged with green. The legs are rust-red, and the tarsi brown. The ordinary length is about an inch.

This is a very common insect throughout France, where it is known by the name of *le Jardinier;* but it becomes rare as we advance northward, occurring very seldom in Germany and Sweden. A few instances are recorded of its having been taken in Britain, but it must be ranked among the rarest of our indigenous beetles.

CARABUS CLATHRATUS.

PLATE II. Fig. 2.

Fabricius.—Olivier.—Gyllenhal, Insec. Suecica, p. 67.—*Dejean, Spec. Génér.* p. 108.

This species is about an inch in length. It is of an oblong-ovate form, and wider in proportion to its length than most other species of the genus. The colour is dark brassy, varying considerably in shade in different individuals. The head and thorax are very faintly punctured, and the latter has the hinder angles very little produced. Each elytron has three elevated lines, and a triple series of rather deep excavations, which are of a golden-yellow or copper colour, united by an oblong tubercle rather indistinctly formed. The outer edge of the elytra is slightly sinuated at the apex in both sexes. The under side of the body and the legs are black. This was esteemed till lately one of the rarest kinds of the British Carabi. Although very scarce in England, it is now however ascertained to be pretty copiously distributed over the Western and Northern Highlands of Scotland. Throughout the southern division of the country, the most common species of the genus are *C. catenulatus*, *C. hortensis*, and *C. violaceus*; but as we advance northwards the two latter gradually become scarce, and their place is supplied by *C. glabratus* and *C. clathratus*. Of

these two, the former is the most abundant in the northern counties of Scotland, and the elevation at which it is found on the mountains shows it not to be abhorrent even of a more northern climate. The latter occurs in considerable numbers in the north-west district of Sutherlandshire, and, next to C. glabratus, is the most common species, C. catenulatus becoming scarce, and the specimens small and dwarfish, which may be assumed as an indication of its having nearly reached the natural limit of its extension in a northern direction.*

The genus TEFFLUS, which was first constituted by Dr Leach, differs from the two preceding genera in having the labrum or upper lip entire or without any notch. It includes only a single species, which has been named after a celebrated naturalist of Vienna.

TEFFLUS MEGERLEI.

PLATE II. FIG. 3.

Carabus Megerlei, *Fabricius*, *Syst. Eleuth.* p. 169.—*Dejean*, *Spec. Génér.* ii. p. 21.

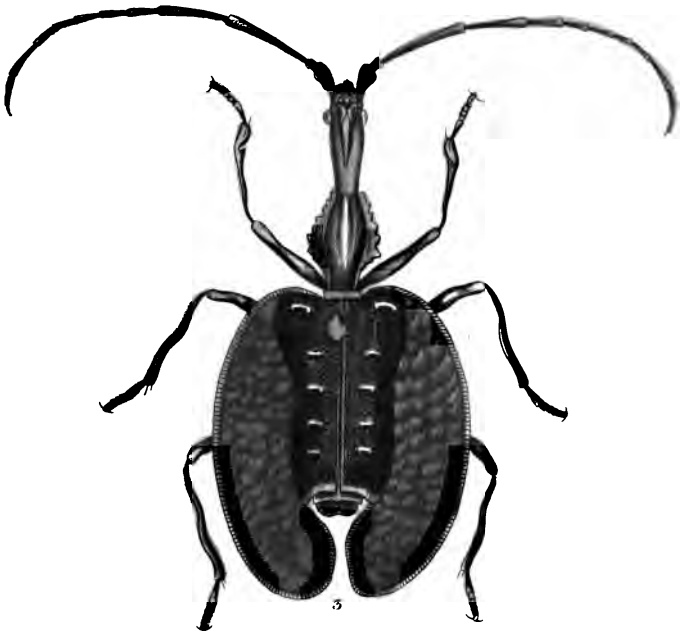
This insect is seldom much short of two inches in length. It is entirely of a uniform glossy black

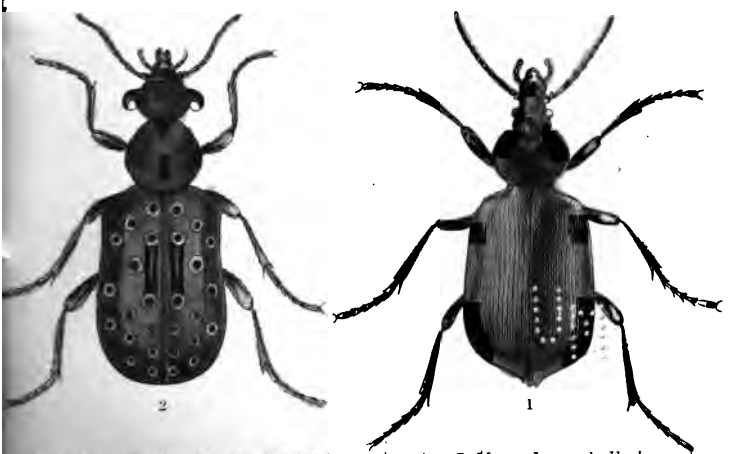
* In a recent expedition to explore the natural productions of Sutherlandshire, upwards of forty specimens of C. clathratus were procured, and C. glabratus might have been obtained almost in any number.

colour, except the eyes, which are yellowish. The outline of the thorax approaches to a hexagonal form; the surface is thickly covered with deep punctures, which run together and render it very rough; the margins are slightly elevated, and there is a faint line down the centre. The elytra are elongate-oval and very convex, each of them having seven longitudinal ridges, which unite at the extremity: in the bottom of the furrows between these ridges there is a row of small tubercles. It inhabits Senegal and the coast of Guinea.

The genus Calosoma is chiefly distinguished from the true Carabi, to which it is very closely allied, by possessing wings; by the third joint of the antennæ, which is considerably longer than the others, and somewhat sharp on its outer edge; by the mandibles being destitute of teeth; and by the form of the thorax, which is somewhat transverse, that is, wider than long, and equally rounded on the sides. The form of the elytra likewise differs, as they approach more to a square shape than is usual among the carabideous tribes. Both as larvæ and in their perfect form, these insects prey upon other species of their own class. The grubs, which resemble a small black worm, take up their abode in the nests generally of the processionary moth (*Lasiocampa Processionea*), and devour the caterpillars in great numbers. When in a state of repletion and inactivity from excessive gluttony, they are sometimes attacked and devoured by the smaller individuals of

PLATE 3.





1. Calosoma Sycophanta. 2. Elaphrus riparius. 3. Mormolyce phyllodes.

Lizars sc

their own fraternity. Although this genus is not extensive, the species are very widely distributed. In Europe they range from Sweden to the shores of the Mediterranean; several occur in Senegal and at the Cape of Good Hope; and a considerable number inhabit America and the eastern regions of Asia. The only kinds known as British are C. inquisitor and that which we have figured: the latter is

CALOSOMA SYCOPHANTA.

PLATE III. Fig. 1.

Fabricius, Syst. Eleuth. p. 212.—Carabus sycophanta, *Olivier*, iii. 35, p. 42, No. 43, t. 3, fig. 31.

It does not exceed ten or eleven lines in length, the figure on the plate being somewhat enlarged. The colour of all parts of the body except the elytra is violet-black, sometimes slightly glossed with green. The head and thorax are covered with minute punctures and irregular transverse wrinkles; the former having two deep longitudinal impressions between the antennæ, and the latter a faint line down the centre. The scutellum is black, and nearly smooth. The elytra are of a rich green, glossed with golden yellow; in shape somewhat like a shield, and marked with closely placed striæ, which have small punctures in the bottom, and a row of rather large and remote punctures on the fourth, eighth, and twelfth interstices.

This insect is of frequent occurrence in all the middle and southern countries of Europe, but it becomes scarce in the north. Few instances are recorded of its having been observed in Britain, and an indigenous specimen is consequently regarded as a valuable acquisition by collectors. Mr Kirby mentions that one was taken at Aldborough in Suffolk, by Dr Crabbe, the celebrated poet; another by a young lady at Southwold, which is now in the cabinet of W. J. Hooker, Esq.; and a third by a boy at Norwich, crawling up a wall, which was purchased of him by S. Wilkin, Esq.

ELAPHRUS RIPARIUS.

PLATE III. Fig. 2.

Cicindela riparia, *Linn.*—*Donovan's British Insects*, vol. ix. p. 301.

The above figure represents this beautiful insect as it appears under a very high magnifier. The colour of the body is brassy green, with coppery reflections. The head and thorax are very thickly punctured, and the latter has a short deep groove in the middle. The elytra are very thickly covered with minute punctures, and each is ornamented with four rows of rounded spots, rather faintly marked, which are purple in the centre, and surrounded with a ring of a metallic lustre. The spaces between these ocellated spots are very little elevated, except one

near the middle of the interior row, which is large, somewhat square, and very highly polished. The under side of the body and legs are bronzed green, except the base of the thighs and greater part of the tibiæ, which are pale reddish yellow.

This insect is of frequent occurrence in most parts of Britain. The genus derives its name from a Greek word, referring either to the nature of the place which the species frequent, or to the activity of their motions.* It is distinguished by the antennæ gradually becoming a little thicker towards the extremity; by the thorax being at least as long as broad, and nearly of the same width as the head; by the large and very prominent eyes; and by having the four first joints of the anterior tarsi slightly dilated in the males. It contains only a few species, some of which bear such a strong resemblance to each other, as to countenance the conjecture that they may be mere varieties. They frequent marshy places, and the margins of lakes and ponds, running about with remarkable celerity during the heat of the day. They are most prevalent in the northern parts of Europe, the more common kinds becoming scarce in the south, and two or three not extending further than the northern extremity of Germany. There is one species found in America.

* Ελος, *a marsh*, or ελαφρος, *light, active*.

MORMOLYCE PHYLLODES.

PLATE III. Fig. 3.

Hagenbach, Novum Coleop. Genus.—Dejean, Spec. Gén. t. v. part ii. p. 714.—*Latreille, Regne Anim.* t. iv. p. 400.

This insect is so peculiar in its form and structure, that it is difficult to determine what place it ought to occupy in a systematic arrangement. It possesses little in common with the genera associated with it by the continental naturalists, except the elongation of the third joint of the antennæ. In its flat and dilated elytra, it bears considerable resemblance to certain neuropterous species of the genus *mantis*, which are remarkable for their likeness to the withered leaves of trees. It is this circumstance that has suggested the above specific name, which is expressive of *resemblance to a leaf*. The head and thorax are narrow and elongated, and the latter has a dilated portion on each side which is scolloped on the outer edge. The abdomen is likewise rather narrow, and the portion of the elytra which covers it is somewhat convex, reticulated, and marked with a double series of rather large impressions; the portion of the elytra projecting beyond the abdomen is very broad and flat, and is somewhat waved on the surface. The tibiæ are crooked, and the anterior pair have a deep notch near the apex. The general colour of the insect is blackish brown,

and it is somewhat shining. It is liable to great variation in size, some of the specimens which we have seen, among an extensive series in the possession of James Wilson, Esq. measuring three and a fourth inches in length, and an inch and a half across the elytra, while others do not exceed two inches in length and one in breadth. It is a native of Java, and seems to occur in considerable plenty in some parts of the country.

DYTISCIDÆ.

A numerous group of carnivorous beetles, belonging to the present section, inhabit the waters of lakes and ponds, both as larvæ and in their perfect condition. Although frequenting an element so different in its nature from that in which other insects live, there is no very marked difference in their structure, a slight modification of certain parts sufficing to adapt them to their new abodes. Their motions are effected by means of the hinder pair of legs, which are rather long and flat, and have the tibiæ and tarsi densely fringed with long stiff hairs, presenting a pretty broad surface to the water. Their respiratory apparatus in no respect differs from that of other insects; but, in order to bring the stigmatic openings in contact with the air, they are obliged from time to time to repair to the surface. This is speedily effected merely by stopping the movements of the legs; for as the body is specifically

lighter than water, it obeys the tendency to float upwards as soon as the counteracting force ceases to be applied. When resting on the surface the head is turned downwards, and the legs extended at right angles with the body, of which the only portion that appears above the water is the extremity of the abdomen, where the air is admitted by the tips of the elytra being slightly raised; and when the insect descends, it carries along with it a bubble of air resembling a globule of quicksilver. If they wish to remain below the surface with their legs unemployed, they can do so only by adhering to the roots or stem of some aquatic plant.

They are strictly an amphibious family; for, although water is their favourite element, they survive for a long time on moist land, and usually fly about in the evening twilight, or even during the darkness of the night. Their flight is rapid and sustained, and may be assisted in certain species of *Dytiscus* by a kind of winglet, similar to that found in the majority of two-winged flies, which is placed under the base of the elytra. All the species are extremely voracious, as might be inferred from the structure of the masticatory and other organs, which are very fully developed. Their usual prey are the larvæ of gnats, ephemeræ, and dragonflies; and the more powerful kinds are said to attack with success animals considerably exceeding themselves in size. By far the most conspicuous

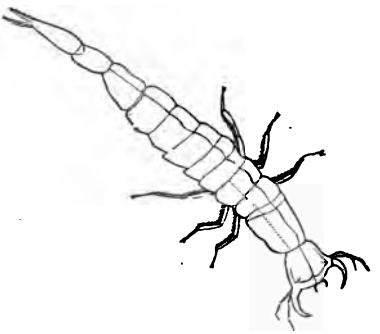
genus in the family, is that first established by Linné under the name of

DYTISCUS,

a term derived from δυτης, which signifies a diver. In its present restricted form, it is distinguished by having the antennæ setaceous, that is, tapering slightly from the base to the apex; by the truncated terminal joint of the labial palpi; and by having the anterior tarsi dilated in the males into a rounded plate. The three basal joints of the tarsi are dilated in the middle pair of legs—a circumstance which chiefly discriminates the Dytisci proper from the genus Acilius of Dr Leach—and the elytra of the female are usually furrowed.

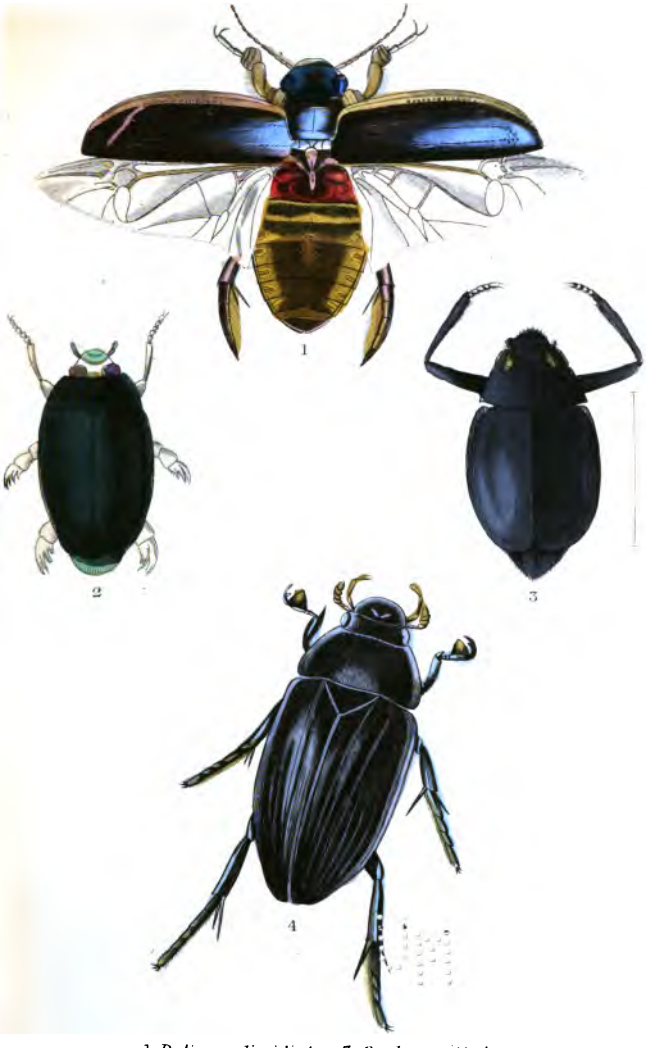
The larvæ are narrow and elongate, composed of twelve segments, including the head, which is large and strong, bearing short antennæ, and armed with two powerful jaws. The last named organs, which are long and incurved, are perforated at the tip, so that they not only serve to seize and lacerate the prey, but also form a tube through which its juices are absorbed. The anal segment is slender and conical, and is furnished with two projecting appendages, by means of which the animal is enabled to push itself forwards in the water, and rise to the surface for a supply of fresh air. The three segments behind the head are each provided with a pair of legs, which are more or less fringed with

hairs, and no doubt assist materially in swimming. The food of the larvæ is similar to that of the perfect insect, and they are perhaps even more voracious in their early condition than after they have undergone their final change. The following cut represents the larva of *Dytiscus marginalis*, the most common species throughout the southern parts of Britain.



The largest species of Dytiscus with which we are acquainted is *D. latissimus*, which is found in Germany and the north of Europe. About eight or nine different kinds inhabit Britain, some of which are common in England; but they become scarcer in the more northern parts of the island. The species represented, for which we are indebted to Mr Curtis' beautiful figure, is

PLATE 4.



1. *Dytiscus dimidiatus.* 3. *Cyclous vittatus*
2. *Gyrinus natator.* 4. *Hydrous piceus.*

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DYTISCUS DIMIDIATUS.

PLATE IV. FIG. I.

Bergstraesser Nomenclatur, pl. 7, fig. 1.—*Curtis' Brit. Ent.* iii. pl. 99.

The colour is brownish black tinged with olive green. The antennæ and upper lip are yellow, and there is a triangular or crescent-shaped spot of rust red on the forehead between the eyes. The thorax is widely margined on each side with yellow, and a broad stripe of the same colour runs along the whole of the external margin of the elytra: the surface of the latter is very smooth in the males, and each is marked with three rows of punctures. The under side of the body, and the legs, are yellowish, with the sutures of the breast black. The lobes of the sternum, which afford very distinctive characters in this group, are obtuse in the present species.

It has occurred at Cambridge, and in some other parts of England.

There is another group of aquatic beetles, the species of which, although much inferior in size to those just described, are still more fitted to attract attention by their numbers, brilliant appearance, and interesting manners. These insects constitute the genus

GYRINUS,

a word sometimes used by Aristotle and other Greek writers, and which is derived from a verb signifying to *move in a circle.* They afford a few well-marked characters, by which they are readily distinguished from all their aquatic associates. The antennæ are short and thick, and are attached to the head in such a manner as to resemble ears. They consist of a clavate mass formed of seven closely joined rings, which is attached by a slender peduncle to the upper and internal edge of a large radical joint furnished with an auricle on its outer side, which, like the lid of a box, shuts in the antennæ when unemployed, and protects them from the water.* The anterior legs are long, and formed for walking, or to act as instruments of prehension; the four hinder ones are very short, compressed and ciliated externally, bearing a strong resemblance to the paddle of an oar. The head is sunk in the thorax as far as the eyes, and the latter are divided by a process from the anterior part of the head, in such a manner that there appear to be two eyes above and two below—a mode of structure admirably adapted to the wants of the insect, which requires, at the same time, to observe objects both in the air and water.

* Kirby and Spence's Introd. to Entom. iii. 516.

Throughout the greater part of the year there is scarcely a sheltered pool without a group of these agile little creatures, pursuing their avocations with the most sportive alacrity. Their chief occupation is swimming rapidly along the surface in concentric circles, or darting about in irregular gyrations, an exercise which they keep up during the whole day, without any apparent object but the love of motion. Their bodies are so highly polished, that they shine like a piece of burnished metal, and not a particle of water can adhere to them. When approached or otherwise interrupted, they speedily scatter or dive under the water, but soon re-appear and resume their sports. Their circular movements are no doubt produced by the natatory legs on the one side being more rapidly moved than on the other, as a boat is turned when the rowers on one side cease to ply. In collecting into parties, and leading up their mazy dance together in the sunshine, we may suppose these little creatures to be actuated by the same social feeling which Mr Wordsworth has ascribed to the gnat-like flies (*Tipulidæ*), which assemble in choirs, and may be seen in sheltered situations even in the middle of winter, alternately rising and falling with a rapid undulatory motion.

> Nor wanting here to entertain the thought,
> Creatures that in communities exist,
> Less, as might seem, for general guardianship,
> Or through dependence upon mutual aid,
> Than by participation of delight,

And a strict love of fellowship combined.
What other spirit can it be that prompts
The gilded summer flies to mix and weave
Their sports together in the solar beam,
Or in the gloom and twilight hum their joy?

These insects are not numerous in Britain, the registered species not exceeding eight, and it is probable that at least two of these are merely varieties. The most common in this country, as well as throughout the middle and northern parts of Europe, is

GYRINUS NATATOR.

PLATE IV. FIG. 2.

Linn.—Fabricius.—De Geer, Insect. iv. xiii. 4, 19.

This species, of which we have given a greatly enlarged representation to show the form of the legs, is nearly three lines long, of an ovate form, blue black, with a metallic lustre, and highly resplendent. The thorax is marked with three transverse lines on each side, of which the anterior one is punctured and runs parallel with the margin, the second is continued across the disk, and the posterior one abbreviated and bent forward. The scutellum is triangular, narrow, and elongate. The elytra are rather convex, the margin turned in at the sides and of a yellowish colour beneath, and the

surface of each marked with eleven striæ or longitudinal lines composed of minute punctures. The breast is pitch red, and the terminal segment of the abdomen, together with the legs, is of a ferruginous hue.

The following lively account of the manners of this species is given by a popular writer. "Water, quiet, still water, affords a place of action to a very amusing little fellow, which, about the middle of April, if the weather be tolerably mild, we see gamboling upon the surface of the sheltered pool; and every schoolboy, who has angled for minnows in the brook, is well acquainted with this merry swimmer in his shining black jacket. Retiring in the autumn, and reposing all the winter in the mud at the bottom of the pond, it awakens in the spring, rises to the surface, and commences its summer sports. They associate in small parties of ten or a dozen, near the bank, where some little projection forms a bay, or renders the water particularly tranquil; and here they will circle round each other without contention, each in his sphere, and with no apparent object, from morning until night, with great sprightliness and animation; and so lightly do they move on the fluid, as to form only some faint and transient circles on its surface. Very fond of society, we seldom see them alone, or, if parted by accident, they soon rejoin their busy companions. One pool commonly affords space for the amusement of several parties; yet they do not unite or contend, but

perform their cheerful circlings in separate family associations. If we interfere with their merriment they seem greatly alarmed, disperse, or dive to the bottom, when their fears shortly subside, as we soon again see our little merry friends gamboling as before. This plain, tiny, gliding water-flea seems a very unlikely creature to arrest our young attentions; but the boy with his angle has not often much to engage his notice, and the social active parties of this nimble swimmer, presenting themselves at these periods of vacancy, become insensibly familiar to his sight, and by many of us are not observed in after life without recalling former hours, scenes of, perhaps, less anxious days; for trifles like these, by reason of some association, are often remembered, when things of greater moment pass off and leave no trace upon the mind."*

CYCLOUS VITTATUS.

PLATE IV. Fig. 3.

This insect exemplifies an exotic group, very closely related to the Gyrini, but offering so many minute modifications of structure as to warrant their separation into a distinct genus. The most obvious difference is the want of an apparent scutellum in *Cyclous*, the great size of the body, and the length

* Journal of a Naturalist.

of the anterior legs. The species figured is about nine lines long and five broad. The colour is bluish black, slightly glossed with purple, and having faint coppery reflections; the whole surface highly polished and resplendent. During life the purple and blue form pretty distinct bands on the elytra, especially towards the sides. The under side of the body is pitch brown, the natatory legs paler: the fore-legs are very long, and of a brownish-black colour. It was received from Java.

Three principal or typical forms prevail among beetles of strictly aquatic habits, to one or other of which nearly all of them may be regarded as referrible. Two of these have just been described as characterising the families *Dytiscidæ* and *Gyrinidæ*, and we shall now proceed to point out the distinguishing marks of the third. Many of the species of which it is composed formed a part of the great Linnæan genus Dytiscus, but they differ so essentially from the insects to which that term is now applied, that Latreille, in his systematic arrangement, has removed them to a great distance from their former associates. Most other naturalists, however, have to a certain extent preserved the connection, owing to the affinity that arises from their inhabiting the same element, and presenting some points of resemblance in structure. The most striking character is the great length of the maxillary palpi, which are often considerably longer than the antennæ—a circumstance which has led the group to

be distinguished by the name of PALPICORNES. The antennæ usually consist of nine joints, which become larger towards the upper extremity, and are connected by a filament, which has the appearance of passing through them. The genus most deserving of notice, is that first established by Dr Leach under the name of *Hydroüs*. It is known by having the labrum entire, the posterior claws bifid, the elytra narrowing gradually behind, and the great size of the teeth on the internal edge of the mandibles.

HYDROUS PICEUS.

PLATE IV. FIG. 4.

Dytiscus piceus, *Linn.*—Hydrophilus piceus, *Fab.*—Hyd. piceus, *Curtis' Brit. Ent.* v. pl. 239 (*from which the accompanying figure is taken*).

The ground colour is black, inclining to olive, and the margins of the elytra are faintly tinged with green and purple. The antennæ and organs of the mouth are reddish. Each wing-case is marked with eight dotted lines, and the alternate interstices with an irregular series of dots. The breast is clothed with yellowish hair, and there are several yellow spots on each side of the abdomen. The legs are of a pitchy colour, with the extremity of the tarsi, and the hairs with which they are fringed, reddish brown.

This is the largest aquatic beetle inhabiting Britain, and, indeed, with the exception of the Stag-

beetle, it may be considered the most bulky of our indigenous Coleoptera. It is common in the southern parts of England, but becomes rare in the north, and has not been observed in any part of Scotland. In its perfect state it is by no means so rapacious as the Dytisci, sometimes even feeding on vegetable substances; but the larva is of such destructive and blood-thirsty propensities that it is known in France by the name of *ver-assassin*. In that early condition it resembles a large soft worm, of a somewhat conical form, provided with six feet, and having its large scaly head armed with two formidable jaws. The head moves with such freedom in all directions, that it can readily seize small shell-fish and other molluscæ floating on the surface, without altering the horizontal position of the body maintained in swimming; and it is even bent backwards, and devours its prey more conveniently by using the back as a kind of support. These larvæ swim with facility, and have two fleshy appendages at the tail, by means of which they suspend themselves at the surface with their head downwards when they have occasion to respire.* The female beetle spins a silken bag for the reception of her eggs, similar to that which may at any time be seen attached to a dark-coloured spider (*Lycosa saccata*), of common occurrence under stones, and interesting for the maternal solicitude she shows in protecting her embryo progeny. In

* Cuvier, Règne Animal, iv. 523.

this receptacle they are left to swim about till they are hatched.

BRACHELYTRA.

The insects belonging to the second great family of the Coleoptera with five joints in each foot, form a well-defined group, readily distinguishable from their associates by their peculiar aspect. The body is narrow and elongated, and in its general form bears considerable resemblance to that of the *Earwig*. The elytra are so short that they seldom cover more than the base of the abdomen; a character which has caused the family to be distinguished by the name BRACHELYTRA.* This peculiarity in the form of the wing-cases is obviously designed to render the body more flexible, by removing every obstacle to the motions of the abdomen. That part accordingly possesses a great degree of suppleness, and is capable of being inflected in almost every direction. When the animal is alarmed, or repelling the attack of an assailant, it bends the abdomen forwards over its back, and protrudes two conical vesicles from the extremity, which in certain species emit a strong scent of sulphuric ether. While in this attitude, the jaws are usually kept extended to their utmost stretch, by which the appearance of the larger kinds is rendered sufficiently formidable to

* From βραχυς, *short*, and ελυτρον, *a wing-case*.

avert the attack, not only of other insects, but of much more powerful foes. Notwithstanding the small size of the wing-cases, they suffice for the protection of the wings, which, when in a state of inaction, are folded up with great nicety, in order to bring them within a narrow compass; this operation is assisted by the extremity of the abdomen, which can be reverted sufficiently to push the wings under their cases.

These insects live for the most part under stones, in excrementitious substances, decaying wood, and mushrooms; many of the kinds inhabiting America are observed most frequently flying about trees, in search of caterpillars and minute insects. They are extremely voracious, and the larger kinds devour indiscriminately whatever other species they can subdue. The larvæ are very similar to the perfect insect, but of a softer substance and a more conical form. In the latter the last segment of the abdomen is lengthened in the shape of a tube, and furnished with two hairy appendages.

The amount of known species does not fall much short of a thousand, and nearly eight hundred have been found in Britain. They were all included by Linnæus in his comprehensive genus Staphylinus, but are now arranged in a multitude of subordinate genera. The term Staphylinus is now restricted to such as have all the palpi filiform, and the antennæ inserted above the labrum and mandibles, between the eyes. The general appearance of the insects

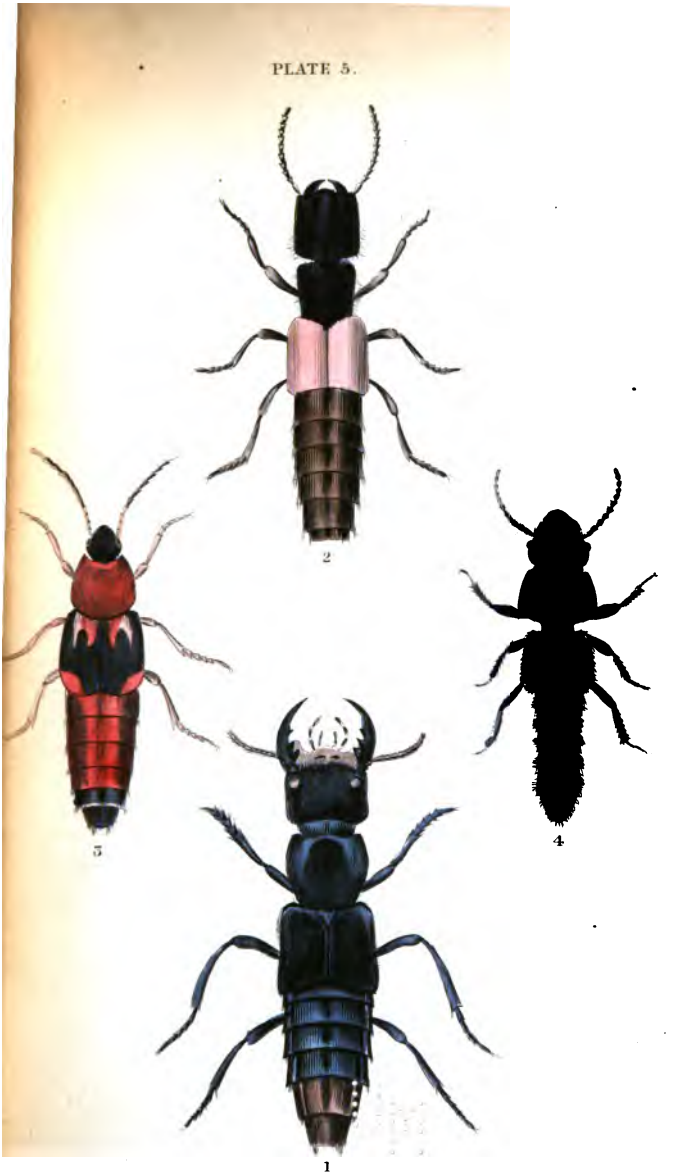
of this genus is exemplified in the conspicuous species represented.

STAPHYLINUS ERYTHRURUS.

PLATE V. Fig. 1.

It is about an inch and a half in length, of a black colour, rather smooth and glossy, with the two last segments of the abdomen rust red. The mandibles are very large, and armed with strong teeth on their internal edge. The head, which is large and square, having the surface thinly punctured, is united to the thorax by a short neck. The thorax is nearly half an oval, and considerably narrower than the head and elytra. The latter are rather thickly punctured, and have a narrow longitudinal ridge on each side of the sutural line. The abdomen is black, with the two apical segments deep red, and fringed on the sides with hair. The under side of the body, and the legs, are black.

The individual from which the above figure is taken was obtained from North America.



1. *Staphylinus erythrurus*. 3. *Bolitobius atricapillus*.
2. *Xantholinus fulgidus*. 4. *Ziraphorus excavatus*

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XANTHOLINUS FULGIDUS.

PLATE V. FIG. 2.

Staph. fulgidus, *Paykull.*—Othius fulgidus, *Leach, Stephens.*—*Olivier*, iii. No. 42, pl. 4, fig. 34, *a*, *b*, *c*.

This genus includes such brachelytrous insects as are of a linear shape, with the head and thorax in the form of an elongated square, the antennæ placed near each other at the base, and in general suddenly bent, or geniculated, as it is called, and having the greater number of the joints somewhat granular or cup-shaped. The legs are rather short and strong, and the anterior tarsi very slightly or not at all dilated. The species, of which we have given a magnified figure, is of frequent occurrence in most parts of Britain and the north of France. The head is oblong-ovate, of a glossy black colour, punctured on each side, and having a transverse series of three or four remote punctures between the eyes. The thorax is nearly of the same colour as the head, with a few small punctures on each side, among which three larger ones are observable. The elytra are of a deep red, shining, punctured, and clothed with short hairs. The abdomen is black, the terminal segment, as well as the under side of the body, pitch-red. The legs, antennæ, and the organs of the mouth, are light-red.

BOLITOBIUS ATRICAPILLUS.

PLATE V. FIG. 3.

Staphylinus atricapillus, *Fabricius*, *Olivier*, iii. No. 42, pl. 4, fig. 39, *a*, *b*.—Tachinus atricapillus, *Gravenhorst*, *Monog. Microp.*

This generic group was first separated by Dr Leach from the genus Tachinus of Gravenhorst. It includes about twenty small species, which appear to be found only in Europe and North America. They are known by having the body narrowed at both ends, the thorax nearly as long as wide, the anterior part of the head rather produced, and the four posterior tarsi considerably lengthened. They are ornamented with strongly contrasted marks of red, pale yellow, and blue black; and the surface is remarkable for its high polish. All the species feed on mushrooms, boleti, &c., and seem most partial to them when in a putrescent state. *B. atricapillus*, of which we have given a magnified figure from Olivier's Entomologie, inhabits Britain, France, and most of the northern and middle countries of Europe. It varies from three to four lines in length, and is of a glossy black on the head, with the mouth and palpi reddish. The thorax is glossy red, without punctures, except on the sides: the elytra bright bluish black, with a pale crescent-shaped mark at the base of each, and three faint punctured lines along the

disk; the abdomen shining red, with the two last segments black. The legs and four lowest joints of the antennæ are pale red, the six following joints of the latter black, and the terminal one pale red.

The only other genus of this family now to be illustrated has been named ZIROPHORUS. Its distinctive characters are, the depressed body, the teeth on the outer edge of the anterior tibiæ, the transverse head (*i. e.* wider than long), square thorax, attached to the abdomen by a kind of narrow peduncle, and the size of the mandibles, which rather exceed the length of the head, and are deeply dentate at the extremity. All the species, not exceeding seven in number, are natives of America and the great islands on the east of Asia. They invariably live under bark in a state of decomposition, a process which they greatly hasten by perforating it with numerous holes, and making it pervious to air and moisture. The most common species is *Z. scoriaceus*;* that which we have represented bears considerable resemblance to it, and is named

* Figured in Griffith's Translation of Cuvier's Règne Animal, iv. pl. 32.

ZIROPHORUS EXARATUS.

PLATE V. FIG. 4.

Ziroph. exaratus, Dejean.

The length is about nine lines. It is of a uniform black colour, very smooth and shining, the tarsi alone, and the hairs on the antennæ and legs, being brown. The mandibles are slightly curved upwards at the tip, and furnished with two or three large angular projections or teeth. The head, which is very short and wide, has a deeply impressed line down the middle, meeting at right angles a transverse one behind the head. The thorax and elytra are nearly of equal width, the surface flat, very smooth and shining, and the former having a line down the middle. The abdomen is very narrow, and fringed with brown hairs, the terminal segment conical. The under parts of the body and legs are black and shining; the anterior tibiæ armed with small teeth on the outer edge. The tarsi are brown or pitch-red. Inhabits Brazil, occurring not unfrequently.

SERRICORNES.

The next division of the pentamerous Coleoptera which presents itself to our notice, includes an extensive variety of species, in which the antennæ are more or less obviously serrated or pectinated, on

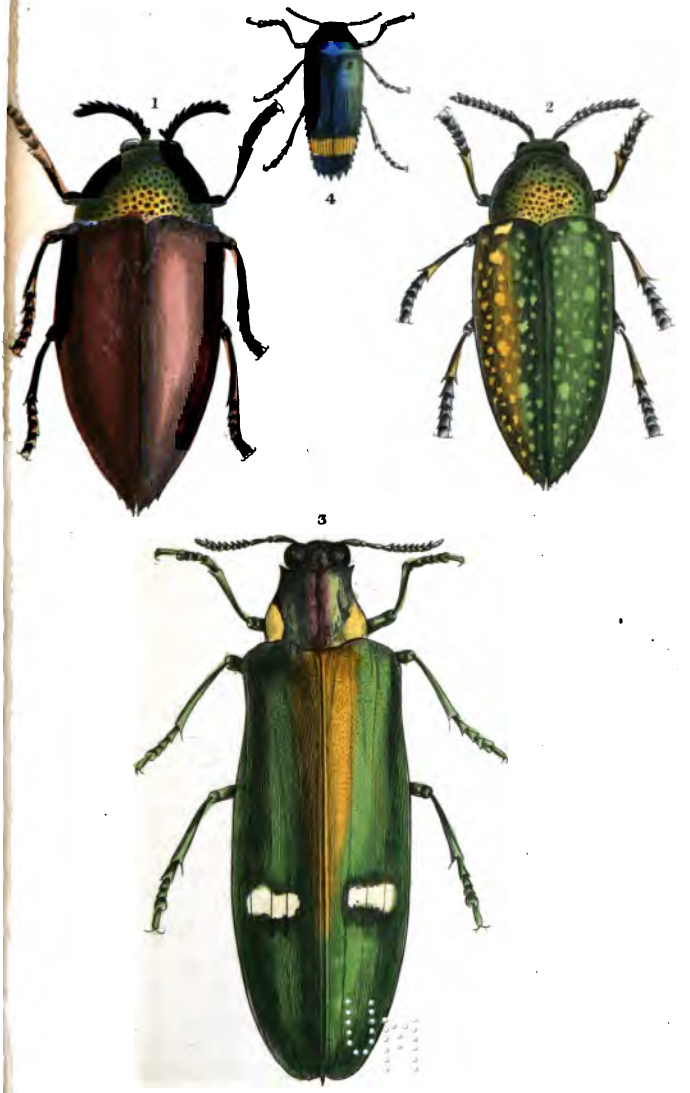
which account they have received the above name. Many of these insects are distinguished by a peculiar conformation of the middle portion of the breast, which lies between the two anterior legs, and is properly called the *prosternum*. It is defined on each side by a longitudinal groove, which sometimes receives the antennæ; the anterior part is dilated and advanced close upon the mouth, while the opposite extremity is prolonged into a point which is admitted into a cavity placed in the hinder part of the breast, a little before the insertion of the middle pair of legs. Such as exhibit a structure of this kind constitute the section *Sternoxes*, a term which bears reference to the acute process of the breast just alluded to. In other instances the prosternum is not dilated below the head, and scarcely ever produced into a spine behind; and the body, instead of being firm and rigid, as in the species of the former section, is usually of a soft and flexible consistence. The latter circumstance has suggested the name of Malacodermes for this section, a term composed of two Greek words signifying *a soft skin*. Both of these sections comprehend insects of considerable interest, both for their beauty and singular economy, and which require therefore to have some space devoted to their history.

The Sternoxes are divisible into two well-marked families, corresponding to the genera Buprestis and Elater of Linnæus. The Buprestidæ are most readily distinguished by not having the posterior angles

of the thorax prolonged into an acute spine, and by being incapable of leaping. The name Buprestis* was applied by the ancients to certain insects, of what particular kind cannot now be easily determined, which were supposed to be possessed of qualities which rendered them noxious to cattle. Geoffroy transferred the term to another group, under the idea that such an application of it was more in accordance with its original usage, and distinguished the present one by the generic name of *Cucujus*. It now designates a numerous and well-defined family, including nearly 200 known species, many of which are the most beautiful and richly ornamented of the coleopterous tribes. They are adorned with the most brilliant green and golden colours, often glossed with purple and blue, and variegated with bands and markings of the highest metallic lustre. A few species inhabit this country, but several of the larger kinds included in the British Fauna have been introduced without sufficient authority. Their proper geographical position is within the tropics, where they may be seen flying about in great numbers in the open parts of the forests and on the margin of rivers, or reposing on the trunks and leaves of trees, as if enjoying the heat of the meridian sun, which is reflected with great brilliancy from their polished surfaces.

* From βους, *an ox*, and πρηθω, *I inflame*.

PLATE 6.



1. *Buprestis chrysis.* 3. *Buprestis bicolor.* Lizars sc.
2. ——— *sternicornis.* 4. ——— *amoena.*

BUPRESTIS CHRYSIS.

PLATE VI. FIG. 1.

Buprestis chrysis, *Oliv.* 32, pl. 2, fig. 8, *a*, *d*, *e*.—Bup. sternicornis, *De Geer*.—Bup. sternicornis, *Var. Linn.*—Sternocera chrysis, *Esch. Dejean.*

The body of this species is very stout and convex anteriorly, and the elytra taper towards the hinder extremity. The antennæ are of a blackish colour, and rather shorter than the thorax. The head and thorax are of a brilliant golden green, and the latter is sculptured with numerous excavated dots, rather of large size, which have ash-coloured hairs in the bottom. Each elytron bears three small teeth at the hinder extremity; the surface, although thickly covered with minute punctures, is smooth and glossy, and of a uniform deep chestnut colour, occasionally with a greenish gloss towards the base. The under side is of a brassy green, very highly polished, and the terminal segment is usually margined with chestnut colour; the legs are of the latter hue. The sternum has a strong conical projection directed downwards.

This insect was once regarded as a variety of the following species, from which it differs in several important characters. It is a native of the East Indies, in some parts of which it appears to be rather common.

BUPRESTIS STERNICORNIS.

PLATE VI. Fig. 2.

Oliv. 32, pl. 6, fig. 52, *a*.—Sternocera sternicornis, *Esch. Dejean.*

This fine species is rather of smaller size than the preceding, but very similar to it in form and sculpture. The colour of the whole body is bright green with copper-colour and golden reflections, the antennæ and tarsi alone being blackish. The thorax is very convex, and has its hinder margin produced in the centre in the form of a triangle; the surface is thickly covered with large and deeply impressed punctures. The elytra are pretty thickly marked with minute punctures, and numerous rounded impressions, variable in size, which are filled with ash-coloured scales; one of these placed at the base of each elytron is larger than the rest. At the apex of each elytron there are two small teeth, and another on the external edge at a small distance from them. The sternum is produced into a strong spine, and is bent downwards. Likewise an inhabitant of the East Indies.

BUPRESTIS BICOLOR.

PLATE VI. FIG. 3.

Buprestis bicolor, *Fab.*—Catoxantha bicolor, *Dejean.*

This is the largest and one of the most beautiful species of the splendid tribe to which it belongs. It seems to have been very little known to Entomologists of the old school, since it is not figured, and seldom alluded to, in any of their works. The specific name *bicolor* has no doubt been applied to it on account of the striking contrast between the colour of the upper and under side. The former is deep brassy green, very smooth and glossy; the latter is light brownish yellow. The head has a deep groove down the middle, and the greater part of it is occupied by the eyes, which are of a deep chestnut colour. The thorax is small and depressed, thinly covered with minute punctures, and having a callosity at each of the hinder angles, marked with a pretty large triangular spot similar in colour to the under side of the body. The elytra are very long, and rather convex, punctured anteriorly, each of them having four slightly elevated lines running along their whole length, and a short oblique one near the suture at the base: the colour is brilliant brassy green, with faint coppery reflections towards the sides, and a large transverse spot of yellowish white on each, placed a little behind the middle,

The wings are of a deep smoke brown, finely glossed with blue. The under parts of the body are yellowish brown, and very glossy; some of the incisures, and a large spot between the middle and hinder legs, are nearly black. The legs are shining green, and have a very fine pubescence, which is likewise observable on the sides of the breast. It is a native of Java, but by no means common.

BUPRESTIS AMŒNA.

PLATE VI. Fig. 4.

Kirby, Linn. Trans. xii. 381.

This species is of the most brilliant blue, inclining to green when seen in certain directions, and having a yellow band across the elytra towards the apex. The thorax has no groove in the centre. The elytra are somewhat furrowed; the outer edge is serrated, two of the serratures forming acute teeth on each side of the suture at the hinder extremity. Both the upper and under side of the abdomen are brilliant blue. It is a native of Brazil and other tropical countries of America.

The second division of the Sternoxes forms the family of the Elateridæ. The latter bear a considerable resemblance to the insects of the former family, but are much less convex in their general form, narrower and more elongate, and have the hinder angles of the thorax prolonged into a strong

triangular point like a spine. They are likewise distinguished by possessing the power of leaping to some height into the air when they happen to fall on their back—a provision not required by the Buprestidæ, probably because the more rounded form of their bodies enables them without difficulty to regain their natural position. The legs of the Elateridæ are so short and slender, that without some property of this kind they would be as unable to recover their standing as a reversed tortoise. The spring is produced by bending the head and thorax backwards, and suddenly forcing the projecting point into the hole designed to receive it,—while the action is assisted by the pressure of the elastic elytra and other parts of the body against the plain of position. This operation is attended with a sharp snapping noise, which has caused these insects to be termed click-beetles, in addition to the names of skipjacks and spring-beetles, by which they are likewise known in England.

We are but imperfectly acquainted with the metamorphoses of these insects, and the larvæ of most of them appear to be unknown. The individual described by De Geer (*E. undulatus*) is long and cylindrical, provided with short antennæ, palpi, and six feet. Its body consists of twelve scaly segments, of which the posterior forms a circular plate, furnished with two blunt points curving inwards: underneath there is a large fleshy protuberance, which seems to serve the office of a foot. The grub so

well known in this country by the name of wire-worm is the larva of a kind of Elater (*E. obscurus*).

It is of a very slender form (as will be seen by the accompanying figure), but so tough and horny that it can resist a considerable degree of pressure without injury. It is said to continue five years in the larva state, and during that time it lives in the earth, devouring the roots of various kinds of corn and vegetables. The damage it occasions in this way is so considerable, that sometimes entire fields of corn are destroyed by it. The larva of the fire-fly, we are informed by Humboldt, feeds on the roots of the sugar-cane, and often proves very destructive to that plant in the West Indian islands. Several insects of this family are remarkably distinguished by the power of emitting a bright phosphoric light, which renders them exceedingly beautiful and conspicuous objects among the dark foliage of tropical woods, and when the shades of night have fallen upon the forests. This luminous property, which has procured for them the name of fire-flies, they possess in common with several other coleopterous species, named glow-worms, which belong to a different section, and therefore fall to be considered in a subsequent part of the volume. Besides these two groups, there is another, still more remarkable, known under the English generic appellation of *Lantern-flies*. In these insects the seat of

PLATE 7

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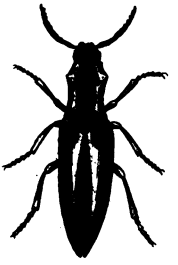

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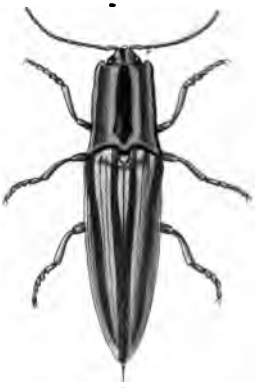

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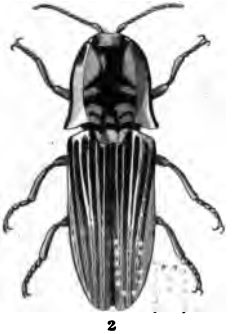


2

1. *Elater noctilucus*
2. ——— *porcatus*
3. ——— *lineatus*

4. *Elater suturalis.*
5. — — *distinctus.*

Lizars sc.

the luminous matter is an elongated projection from the head, in the form of a rostrum or snout, which is dilated in one of the species (*Fulgora lanternaria*) into a figure not unlike a mitre, and in others is fantastically adorned with knobs and spines; through this organ the light is suffused in a lambent effulgence of considerable brilliancy. These insects, however, belong to the order *Hemiptera*, and their history does not fall within the scope of the present notice.

The species of fire-fly that affords the finest exhibition of this interesting phenomenon, is named

ELATER NOCTILUCUS.

PLATE VII. FIG. 1.

Pyroporus noctiluca, *Dejean.*

It is upwards of an inch long, and one third of an inch broad. The colour is a uniform obscure blackish brown, and the body is everywhere covered with a short light-brown pubescence. The thorax is pretty convex, and there are two small depressions (at least in one of the sexes) on the surface before the middle; the hinder angles are produced into a strong conical spine, and between the hinder angle and the middle there is placed on each side a smooth convex round spot of a yellow colour. The elytra are indistinctly marked with rows of small punctures, which are most obvious at the base. The under

parts of the body, as well as the legs, are brownish black, and covered with pubescence of a somewhat lighter hue.

This insect is pretty widely distributed over the intertropical countries of South America, and the West Indian islands. When it walks or is at rest, the principal light which it emits issues from the two yellow tubercles placed at the lateral margins of the thorax; but when the wings and elytra are expanded in the act of flight, another luminous spot is disclosed in the hinder part of the thorax. This luminosity is so considerable, that it is often employed in the countries where it prevails as a substitute for artificial lights. A single insect is sufficient to enable a person to decipher the smallest written character, and when several are brought together, their light is said to suffice for all the ordinary evening occupations of an Indian's dwelling. They are employed for many useful purposes; the Indians are said to have formerly used them instead of flambeaux in their hunting and fishing expeditions, and when travelling in the night they were accustomed to fasten them to their feet and hands. Another important service is rendered by these insects in destroying the gnats and musquitoes, which abound in tropical countries to the incessant annoyance of the inhabitants. Like most other animals of nocturnal habits, the fire-flies are attracted by strong light, and the Indians avail themselves of this circumstance to obtain them for

the purposes above mentioned. The mode in which they are taken, and several curious particulars respecting their appearance and uses, are thus quaintly described by an old author:—"Whoso wanteth cucuij," says Pietro Martire, in his Decades of the New World, "goeth out of the house in the first twilight of the night, carrying a burning fire-brande in his hande, and ascendeth the next hillock, that the cucuij may see it, and hee swingeth the fire-brande about, calling cucuius aloud, and beateth the ayre with often calling and crying out *cucuie, cucuie.* Many simple people suppose that the cucuij, delighted with that noise, come flying and flocking together to the bellowing sound of him that calleth them, for they come with a speedy and headlong course; but I rather thinke that the cucuij make haste to the brightness of the fire-brande, because swarmes of gnattes fly into every light, which the cucuij eat in the very ayre, as the martlets and swallowes doe. Some cucuius sometimes followeth the fire-brande, and lighteth on the grounde; then is he easily taken, as travellers may take a beetle if they have need thereof walking with his wings shut. In sport and merriment, or to the intent to terrify such as are afrayed of every shadow, they say that many wanton wild fellowes sometimes rubbed their faces by night with the fleshe of a cucuius, being killed, with purpose to meet their neighbours with a flaming countenance, as with us wanton young men, putting a gaping vizard over their face, en-

deavour to terrify children, or women who are easily frighted," &c.

During the splendour of a tropical sunshine—

> —— the long, sunny lapse of a summer day's light
> Shining on, shining on—

the sombre hues of the fire-flies attract but little attention amidst the infinite variety of living beings of more imposing form and attractive manners that people to overflowing these prolific lands, while every lesser light is lost in the effulgency of "redundant day." But no sooner do the lofty and umbrageous trees begin to throw their shadows across the landscape, than occasional specks of light are seen to flit amidst the growing obscurity. As the darkness increases, these become more numerous; they mount into the air and shoot athwart the gloom like igneous meteors, and when the underwood is disturbed they rise in such numbers that they spangle the air as with a thousand stars. The brilliancy of this spectacle, so far transcending any similar appearance witnessed in temperate climates, seldom fails to excite the admiration of an European traveller. Its effect on some British visitors has been thus described:

> ———————— Sorrowing, we beheld
> The night come on; but soon did night display
> More wonders than it veiled; innumerous tribes
> From the wood-cover swarmed, and darkness made
> Their beauties visible; one while they streamed
> A bright blue radiance upon flowers that closed

Their gorgeous colours from the eye of day;
Now motionless and dark, eluded search,
Self-shrouded; and anon, starring the sky,
Rose like a shower of fire.*

An appearance alike remarkable for its singularity and beauty, is well fitted to afford imagery to the poetry and figurative oratory of the natives of the countries where it prevails; and if a learned Greek could suppose the hum of an obscure beetle to be the voice of the gods speaking to mankind,† it need less excite our wonder that some savage nations, unacquainted with the causes of natural phenomena, and so prone to consider "holy light" as a divine effulgence, should have regarded even the more obscure manifestations of a supposed celestial principle with superstitious veneration, and imagined these illuminated beings to be the appointed vehicles for conveying the souls of the departed to their final resting place.

The following extract contains an account of the introduction of a few fire-flies into Britain:—"Mr Lees having been struck with the beauty of the fire-fly on his arrival in the West Indies, and becoming desirous to keep them alive, made several attempts during his residence at the Bahamas; but

* Southey's Madoc.

† Dum volant, tanto stridore vel murmure et gemitu potiùs aërem replent, ut per eos Deorum cum hominibus fieri colloquia Laertius scriberet.—*Mouf. Theat.* 134.

was unable to succeed in his object, until he learned from a lady, that the cage containing the insects should be daily immersed in cold water. This is rendered necessary from their natural habitation being in swampy meadows, where, during the day, they probably lie concealed in the wet herbage. Perhaps the introduction of damp moss into the cage (which ought to be made of wood, and not glued together) might be more natural and salutary to the insects. The *Elaters* feed upon the sugar-cane, and should the larvæ do so likewise, which is more than probable, from their being xylophagous, they must do incredible mischief to the planters, as they are produced in abundance in the West Indian islands, and are very generally distributed over them. Mr Lees having taken some sugar-cane to sea with him to feed the beetles upon, he observed that they readily broke the wood away with their mandibles to obtain the saccharine matter on which they fed; and after his stock was consumed, he gave them brown sugar, by which means they were kept alive the whole of their voyage, from June to the middle of September.

"The insect, when roused and in perfect vigour, seems to be completely saturated with the luminous secretion, since the back, when the elytra and wings are expanded, has a phosphoric appearance; and there is a strong light at the base of the abdomen, where the posterior coxæ are attached, which being apparent only in some, I thought might be peculiar

to one sex, but its absence was more probably caused by a languid state of the animal. The light is far more beautiful in colour, and greater in power, than the mild secretion of the glow-worm; and the substance, if removed from the beetle immediately after death, will remain luminous like phosphorus, on the objects on which it is placed.

"It is to be hoped that others will be induced to bring these insects over alive earlier in the season; for there can be little doubt that they would live through a warm summer in this climate. I do not despair therefore of seeing our fair countrywomen at home, as well as abroad, employing these living gems to add to the splendour of their attire. At the Havannah they are collected and sold for ornamenting the ladies' head-dresses at evening parties, when they are, I understand, generally confined under gauze which covers the head, and from among the ringlets of hair these terrestrial stars shine forth with all their beauty."*

ELATER PORCATUS.

PLATE VII. Fig. 2.

Fabricius.—Olivier, ii. No. 31, pl. 7, fig. 74.—Chalcolepidius porcatus, *Esch.—Dejean.*

The body of this insect is of a shining black, but it derives its superficial colour from a coating of

* Zoological Journal, vol. iii. p. 379.

scales, which are either white or green. The head and central portion of the thorax are more or less green, but the scales are usually abraded, when they appear shining black; the sides of the latter are whitish. The elytra are marked with deep furrows, which approximate in pairs, and are more or less filled with white scales, making the surface appear as if lined with white. The under parts of the body, and the legs, are green, except where the black surface is exposed by the scales being rubbed off.

Found in considerable abundance in Brazil, Cayenne, and other parts of tropical America. It is almost always found on the trunks of trees, and falls to the ground when the hand is extended to seize it.

ELATER LINEATUS.

PLATE VII. Fig. 3.

Fabricius.—Olivier, ii. No. 31, pl. 6, fig. 63.—Hemirhipus lineatus, *Latreille*, *Dejean*.

The prevailing hue of this large and conspicuous insect is black, and the surface is covered with a fine pubescence, which gives it a silky gloss. The body is elongate, and rather obtuse at the two extremities. The antennæ are black. The head, outer margin of the thorax, and a line down the middle, are covered with silky pubescence of a reddish colour. The elytra are striated, black, with a

longitudinal elevated line of red down the middle of each, which is turned backwards at the base. The under side of the body, and the legs, are black.

An inhabitant of the same countries as the preceding species, and often found in company with it.

ELATER SUTURALIS.

PLATE VII. Fig. 4.

Fabricius.—Olivier, ii. No. 31, pl. 1, fig. 3, *a*, *b*, *c*, *d*.—Elater angulatus, *Drury's Illustrations*, iii. pl. 47, fig. 5.

This species is liable to considerable variation both in size and markings. The head and antennæ are black, and the former has an angular projection on each side anteriorly. The thorax is rather long and narrow, and is produced on each side before the middle into an acute angle: the colour is yellow, with a broad streak of black down the centre; and occasionally there is a rounded spot of black placed between the dorsal line and the lateral projections. The scutellum is black. The elytra are reddish yellow, with a broad band of black on each side, and another along the suture, which meet at the apex, and gradually become narrower at the opposite extremity, scarcely extending to the base. The legs and under side of the abdomen are reddish yellow, the latter with two longitudinal streaks of black.

Likewise a native of South America, where it appears to be pretty common.

ELATER DISTINCTUS.

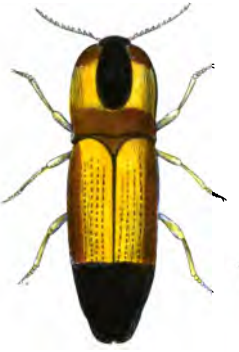
PLATE VII. Fig. 5.

Pericalus distinctus, *Herbst.*—Pericalus acuminatus, *Dejean, Cat.*

This handsome species is of a reddish chestnut colour, very glossy, and almost free from pubescence. The head, which is excavated in the middle, and the two lower joints of the antennæ, are reddish, the remaining joints of the latter dusky. The thorax is deeply punctured, especially towards the sides, and has a black streak down the middle. The elytra are rather convex, and taper to the hinder extremity, where they are produced into a kind of spine; the surface marked with straight punctured lines, a dark-brown band along the middle of each elytron, and another on each side of the sutural line. The under side and legs are chestnut red.

Found in South America, and often observed, according to M. Lacordaire, along with several of the species already described, resting on the stems of trees.

PLATE 8.



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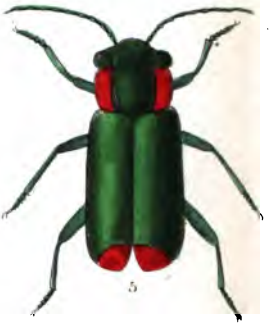

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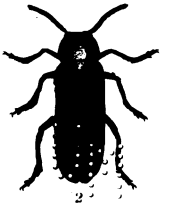

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1. *Elater melanocephalus.*
2. *Lampyris Italica.*
3. *——— Latreillii.*
4. *Lycus festivus.*
5. *Malachius marginellus*
6. *Priocera variegata.*

ELATER MELANOCEPHALUS.

PLATE VIII. FIG. 1.

Fabricius.—Olivier, ii. No. 31, pl. 4, fig. 36, *a*, *b*.—Melanoxanthus melanocephalus, *Esch. Dejean.*

This insect, of which we have given a greatly enlarged figure from Olivier, bears some resemblance to the indigenous species *E. balteatus*. The antennæ and head are black. The thorax is reddish, very smooth and shining, and there is an oblong spot of black extending from the head rather beyond the middle. The elytra are reddish, with the hinder extremity black, the surface marked with punctured lines. The under side and legs are red, the extremity of the abdomen being more or less suffused with dusky black. It is a native of the East Indies.

The section of the SERRICORNES, formed by species with a somewhat flexible integument, comprehends the interesting family of glow-worms, or *Lampyridæ*. It corresponds to the undivided genus Lampyris as constituted by Linnæus. The species may be known by having antennæ approximating at the base, the head small and nearly concealed by the projecting edge of the thorax, and the body depressed or very slightly convex. In the male the eyes are so large as to occupy almost the whole head. The penultimate joint of the tarsi is always divided into two lobes, and the claws are simple;

that is, without teeth or other appendage. But these insects are best known by the remarkable property which many of them possess of diffusing a phosphoric light, a peculiarity which has suggested a name for them in every country where they occur. Only one species, *L. noctiluca*, is to be found in Britain. It is abundant in some of the southern counties of England, but occurs very seldom in Scotland, although it has been noticed in several places in the southern division of that country. One of the most interesting of those indigenous to Europe, is named

LAMPYRIS ITALICA.

PLATE VIII. FIG. 2.

Lampyris Italica, *Linn.*—*Olivier*, *Entom.* ii. No. 28, p. 18, pl. 2, fig. 12, *a*, *b*, *c*, *d*.—Lampyris australis, *Fab.*—Coliphotia Italica, *Dejean*.

This is one of the smallest luminous insects with which we are acquainted, the ordinary length not exceeding three lines and a half. The prevailing hue is blackish brown. The thorax and scutellum are reddish yellow, pretty deeply punctured and pubescent, and the former has sometimes a dusky spot in the centre. The elytra are somewhat rough with numerous and rather deeply impressed punctures. The breast and legs (with the exception of the tarsi) are yellow, and the abdomen dusky black,

with the two terminal segments white, slightly tinged with yellow.

This species is very abundant throughout the southern parts of Europe, particularly in Italy, where it is named *Lucciola*. Contrary to what is observed in the British Glow-worm, both sexes are provided with wings. When the insect either perches or creeps little light is therefore perceptible, but it becomes obvious as soon as the wing-cases are opened for flight. It is not however constant, but has a kind of scintillating appearance, recurring at every other instant, as if disclosed by the opening of the wings at each successive expansion. When the insect is laid upon its back, a position from which it cannot easily recover itself, the light is steady and unvarying. It is of considerable intensity in a single insect, and when three or four are brought together, it is sufficient to render the smallest objects around quite visible. It is apparent in the twilight, but is not fully displayed till the darkness is confirmed. It then becomes a phenomenon of some interest and beauty, as the insects are so numerous and active that their luminous tracks through the air can be traced in all directions,

Upward and downward, thwarting and convolved;

and they spangle the shrubs and herbage with innumerable radiant points. Their appearance and effect in the neighbourhood of Genoa, is thus described by Sir J. E. Smith:—"On the eve of St John

Baptist, the great festival of Genoa, the town was brilliantly illuminated; while along the purple coast to the west, the last rays of the setting sun still trembled on the hills, and the moon arose in the east. To these three contrasted lights was added the singular effect of the innumerable flying glow-worms, darting their momentary splendour through all the streets, gardens, and rooms. We used frequently to catch these little insects, and entangle them in the ladies' hair and head-dresses, a decoration the women in some countries adopt themselves. A lady of Genoa told me a singular anecdote of some Moorish women of rank, taken prisoners by the Genoese, and detained for a ransom. They were lodged in a villa out of the town, and visited, during their stay, by several families. A party going to see them one summer's evening after a hot day, were surprised to find all their doors and windows close shut, and themselves in the utmost terror and distress. They had conceived an idea that these luminous flies were the disturbed souls of their relatives. The common people of Genoa too suppose them to be of a spiritual nature, and to come out of the graves—of course they are beheld with abhorrence."*

* Sketch of a Tour on the Continent, vol. iii. p. 84.

LAMPYRIS LATREILLII.

PLATE VIII. Fig. 3.

Kirby, Linn. Trans. vol. xii. 387, pl. 21, fig. 4.—Selas Latreillii, *Dejean.*

This insect may be regarded as representing a pretty numerous group of glow-worms confined to the tropical parts of America, and differing considerably in structure from the European species. Some of them are the largest of their tribe, and they contribute more than any other to embellish the nights of the torrid zone, as the light which they emit is of considerable splendour, and their flight higher in the air and longer sustained than in the other kinds. They pass the day in a state of inactivity, and are usually found on the trunks of trees, clinging to the bark or concealed in its fissures.

The species represented, which Mr Kirby has dedicated to Latreille, *Entomologorum facile princeps*, is about twelve to thirteen lines in length. The body is ovate, and of a dull black colour. The antennæ of the male consist of ten joints, all of which, except the radical and terminal ones, emit a long, compressed, flexible branchlet from each side: in the female the antennæ are eleven jointed, and deeply serrated on both sides. The thorax is of a pale brownish yellow, marked with three blackish

spots, of which the central one is longest and somewhat triangular. The elytra are very thickly covered with minute punctures; the colour blackish, except the outer margin, the suture, and a broad streak extending from each shoulder rather beyond the middle, which are of a light yellowish brown. The wings are black. It is found in Brazil and other intertropical countries of South America.

The genus *Lycus* is distinguished by having the snout longer than the hinder part of the head, and the antennæ serrated. The elytra are often remarkably dilated at the sides, and usually reticulated on the surface. They are likewise enlarged at the hinder extremity, and rounded, particularly in the females.

LYCUS FESTIVUS.

PLATE VIII. Fig. 4.

Lampyris festiva, *Donovan's Brit. Ins.* xvi. pl. 544.

The length of this insect is about three lines and a half. The colour is a tawny orange, with the apex of the elytra, a spot on the middle of the thorax, and the under side of the body and legs, brownish black. Each elytron has four elevated lines, the spaces between which are deeply punctured. It is said by Donovan to have been found in England, but is considered a doubtful native.

MALACHIUS MARGINELLUS.

PLATE VIII. FIG. 5.

Fabricius.—Olivier, ii. No. 27, pl. 3, fig. 18, *a*, *b*.

This insect affords an example of the family *Melyridæ*, which is characterised by short and filiform palpi, mandibles notched at the point, a narrow elongated body, undivided joints in the tarsi, and claws furnished with a single tooth. The genus Malachius* generally has the joints of the antennæ a little produced on the inner side; the thorax is wider than the head, and has a vesicle, capable of being dilated and contracted, beneath each of the anterior angles. The radical joints of the antennæ are often irregular in the male. The species are numerous, amounting to more than a hundred, but only fifteen of these occur in Britain. They are chiefly European, but a few are found in every quarter of the world. The species above referred to (which is represented as it appears under a powerful magnifier) is a native of France and England. It is of a brassy-green colour, with the sides of the thorax and tips of the elytra of a blood red. The under parts of the body and legs are likewise green, and the antennæ black.

Another tribe of malacodermatous insects consti-

* From μαλακια, referring to the softness of the body.

tute the family *Tillidæ* of Dr Leach. Its principal characters are found in the beautiful species which we have selected to represent it. It was first described by Mr Kirby, under the name of

PRIOCERA VARIEGATA.

PLATE VIII. Fig. 6.

Kirby, Linnæan Trans. xii. p. 392, pl. 21, fig. 7.

In this genus the upper lip is emarginate, the terminal joint of the maxillary palpi compressed and oblong, while the same joint in the labial palpi is hatchet shaped; the body is convex, and the thorax much contracted behind. The colour of the only species known is brownish black on the body. The head and thorax are deeply punctured, and the antennæ are somewhat reddish. The elytra are of a fine red, with four large quadrate yellow spots, one on each shoulder, and two behind the middle forming a band, with several small yellow spots in the space between: behind the yellow band there is another of a brown colour, and the apex is unspotted. The legs are dusky black. It is a native of Brazil.

CLAVICORNES.

The name of this family, like most of those that have preceded it, refers to the structure of the antennæ, which become thicker at the extremity, and

often form a nearly solid club or knob. The species are provided with only two pair of palpi, one of them affixed to the maxillæ, the other to the under lip. The joints of the tarsi are for the most part undivided. The most conspicuous and interesting genus which it contains is named NECROPHORUS, a term nearly corresponding in meaning to the English one *Burying-beetle*, and both of them referring to a remarkable peculiarity in the manners of the insects. The females deposit their eggs in the decaying carcasses of moles, mice, and other small animals, which they previously bury for this purpose. To effect this operation, seemingly so disproportionate to their size and strength, two or three beetles generally unite their labours, and remove the earth from beneath the dead body, which gradually sinks into the excavation. During this process they may be seen dragging at the object from below, and even mounting upon it as if to tread it into the grave. They labour at their task of inhumation with the most unwearied industry. According to Mr Gleditsh, who was the first to give an accurate account of the proceedings of these grave-diggers, four beetles were observed to inter in a very small space of earth, to which they were confined, no fewer than twelve carcasses, few of which were inferior in size to a mole. The object of all this solicitude is the security and comfort of their young, as the carcass, which forms a nidus for the eggs, if left exposed, would run the risk of being devoured

by beasts of prey, or the juices would be speedily evaporated by the heat of the sun, and the maggots thus deprived of their appropriate nourishment. The Necrophori are distinguished by the form of the antennæ, which are very little longer than the head, with the four last joints forming a perfoliate club, as represented in the following figure. The

mandibles are without teeth, and the elytra are of an oblong-quadrate form, leaving three or four of the segments of the abdomen uncovered. The species, amounting to near thirty, are confined, as far as is yet known, to Europe and the northern parts of America. They are almost invariably of a brownish-black colour, frequently variegated with spots and bands of orange yellow. Seven different kinds occur in Britain, one of which is represented on the accompanying plate.

NECROPHORUS HUMATOR.

PLATE IX. Fig. 1.

Silpha Humator, *Olivier.—Marsham's Entom. Brit.—Donovan's British Insects*, ii. pl. 537, fig. 1.

This species is entirely of a brownish-black colour, except the three last joints of the antennæ, which are orange yellow. The head and thorax are very faintly punctured, and the surface of the latter is

PLATE 9.

3

2

1

5

4

1, *Necrophorus Humator*. 3. *Silpha 4-maculata*
2. *Necrodes littoralis*. 4. *Anthrenus scrophulariae*
5. *Hister reniformis*.

Lucas sc.

rather unequal. The elytra are more deeply punctured; each of them with three slightly elevated lines, and a tubercle towards the hinder extremity near the outer angle. The breast is clothed with yellow hairs, and those on the legs are of the same colour. It is frequently met with in England and Scotland, and most of the northern countries of Europe.

NECRODES LITTORALIS.

PLATE IX. FIG. 2.

Silpha littoralis, *Linn.—Marsham.—Curtis' Brit. Ent.* vii. 334.

In this genus the antennæ are considerably longer than the head, but shorter than the thorax, thickening gradually from the fifth joint to the apex. The thorax is nearly orbicular, and the mandibles have a tooth near the middle. The only species found in Britain is that referred to above. It is entirely of a black colour, with the three terminal joints of the antennæ orange yellow. There are three elevated lines on each elytron, the spaces between which are very thickly punctured: the second line is angulated a little behind the middle, and connected with the third by a tubercle. The hinder thighs are very thick, and dentate on the under side. It is found on the shores of the sea and the banks of rivers, under sea-weed, carrion, &c. occurring not unfrequently.

SILPHA QUADRIPUNCTATA.

PLATE IX. Fig. 3.

Linn.—Donovan.—Marsham.—Silpha 4-maculata, *Samouelle's Useful Compend.* pl. 2, fig. 7.

This genus, as originally constituted by Linnæus, was of great extent, and included both the preceding genera, besides several others. In its modern application it comprehends such insects as have the antennæ slightly compressed, and thickening gradually from the seventh joint to the apex. The body is nearly in the form of a shield, depressed or very slightly convex, and the thorax is semicircular, with the anterior part truncated or very obtuse. The species feed chiefly on decaying animal matter, and are of great service in freeing the surface of the earth from putrid substances which might otherwise infect the air. Owing to the reason formerly assigned, few or none of these creatures are found in tropical countries.* They are chiefly confined to the temperate regions of America, and to Europe. Upwards of thirty kinds are named in our entomological catalogues, and about a dozen of these inhabit Britain. *S. quadripunctata*, one of the most ornamental of the tribe, is not unfrequent in France and England and has been found in Scotland as far

* Page 96.

north as Sutherlandshire. It is black and shining, with the sides of the thorax and elytra pale yellow, the latter with two rounded spots of black on each. The length is from five to six lines.

ANTHRENUS SCROPHULARIÆ.

PLATE IX. Fig. 4.

Fabricius.—Byrrhus scrophulariæ, *Linn.*—Anth. Scroph., *Olivier*, ii. No. 14, pl. 1, fig. 5, *a*, *b*.

This insect scarcely exceeds two lines in length, the accompanying figure is therefore magnified to show its structure and markings with greater distinctness. The head is black, and sometimes has a small white spot on the forehead. The antennæ are reddish near the base, but black towards the tip. The thorax is black, with the sides whitish, and the hinder edge frequently of a deep-red colour. The elytra are black, with three bands of white, which are interrupted towards the suture: the latter is deep red. The under side is clothed with white scales, and the legs are brownish black. It occurs in Britain and almost every country of Europe. The larvæ feed on dried animal substances, and are sometimes very destructive in museums, by attacking the skins of preserved specimens. The perfect insects frequent flowers, a circumstance to which the generic name bears reference.

HISTER RENIFORMIS.

PLATE IX. Fig. 5.

This genus is readily recognised by the peculiar form of the body. It is almost square, and the elytra are short and truncated at the extremity. The legs are contractile, that is, they are short and compressed, and capable of being drawn close to the body. The lower joint of the antennæ is very long, and forms an angle with the upper portion which terminates in a rounded knob. All these insects are of small size, and find their nourishment in cadaverous and excrementitious matters. The outer covering is very rigid, and when the legs are contracted, they can bear a great degree of pressure without injury. When alarmed, they lie perfectly still, and often deceive their enemies by simulating death with great accuracy and perseverance. About 120 species are known to entomologists, and of these upwards of 30 inhabit this country. The species figured as an example, is of a glossy black colour, with two spots of red on the elytra. The latter have two or three longitudinal ridges, and are rather thickly punctured at the sides. The under side of the body and legs are likewise black, the latter dentate on their outer edge. It is found in various parts of Europe.

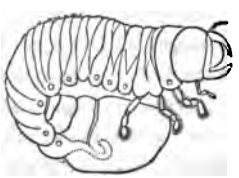
LAMELLICORNES.

This important section of the pentamerous beetles is so designated, because the antennæ terminate in a club or large knob, composed of several laminæ or thin plates, disposed somewhat like the leaves of a book, and which the insects can open and shut at pleasure. They are inserted in a deep excavation, under the lateral edges of the head, and usually consist of nine or ten joints. The anterior pair of legs are somewhat adapted for digging, as the tibiæ are rather broad, and armed with strong spines on the terminal angles and outer sides. As many of these insects feed on substances in a state of decomposition, which scarcely require any further trituration to fit them for food, the mandibles are sometimes of a membranous substance,—a peculiarity not observable in any other Coleoptera.

This division is of great extent, the most recent enumeration of its species making them amount to upwards of 2000. Scarcely more than 120 occur in Britain, but several of these are the most conspicuous and best known of our native Coleoptera, such, for example, as the Stag-beetle and the Cockchafer. The tropical kinds are distinguished by their magnitude, and are by far the most remarkable-looking of their tribe, owing to the variety of form assumed by the head and thorax, and the extraordinary horn-like processes with which these parts are sometimes furnished. Such of the species as feed on flowers

and living vegetation are frequently adorned with very beautiful and brilliant colours, but those that derive their nourishment from decomposed vegetables are usually of a sombre hue.

The larvæ of these insects are long, soft, semicylindrical worms, divided into thirteen segments including the head, which is of a scaly texture, and provided with powerful mandibles. The feet are six in number, and placed on the three segments immediately behind the head. Nine of the rings or segments have a conspicuous stigmatic opening, or air hole, on each side. The hinder portion of the body is much thicker than the other parts, and is usually curved inwards beneath the belly, even when the insect is in motion. Its movements are consequently slow and awkward, and the short scaly feet proving inadequate to support the equilibrium of the arched back, it frequently rolls over, or falls on one side. The general appearance of these grubs will be better understood from the annexed figure of that of the common Cockchafer. Many of them live among excrementitious substances, or decomposed vegetables; others consume the roots of plants, and often occasion very great injury to agricultural produce. Before undergoing the metamorphosis by which they are converted into perfect beetles, the



larva forms for its protection an oval cocoon, constructed of earth and the gnawed fragments of other materials, agglutinated by a viscous secretion which exudes from its body.

The lamellicorn insects may be regarded as constituting two great groups or tribes, corresponding to the two comprehensive genera of Linnæus, Scarabæus and Lucanus. In the former the antennæ terminate in a foliated mass, generally capable of being alternately closed or expanded; but it is sometimes composed of joints that fit into each other, either in a globular form, or in the shape of a reversed cone: the mandibles are nearly alike in both sexes, and the males are frequently distinguished by horns or prominences on the head and thorax.

The first generic group among the SCARABÆIDÆ, which requires to be noticed, has been named

ATEUCHUS.

The term is probably derived from the Greek privative *α*, and *τευχος*, a weapon or implement of war, in allusion to the head being without horns, contrary to what is observed in most of the allied genera. The antennæ consist of nine joints, the three next the apex forming a foliaceous knob. The body is somewhat rounded, and usually rather depressed, and there is scarcely any appreciable mark of distinction in the external appearance of the two sexes. The maxillæ terminate in a membranous

lobe, which is dilated considerably at the tip, and bent inwards. The terminal joint of the labial palpi is longer than the others, and nearly cylindric, but slightly thickened in the middle. The external margin of the elytra is straight without any sinuosity, a character which distinguishes the true Ateuchi from the species that constitute the genus Gymnopleurus. There is no perceptible scutellum, nor any opening at the base of the sutural line indicating its place. The four hinder legs are slender, elongate, and fringed with long hairs; the tibiæ are scarcely thickened at the tip, where they are truncated obliquely, and armed with a strong acute spine. The dilated anterior part of the head is divided into six teeth, and an elevated process of the cheek (strictly the *canthus*) runs nearly across the eye, dividing the upper portion from the lower.

The genus, as above defined, contains about twenty-six species. They are confined to the old world, in which however they have an extensive range of distribution.

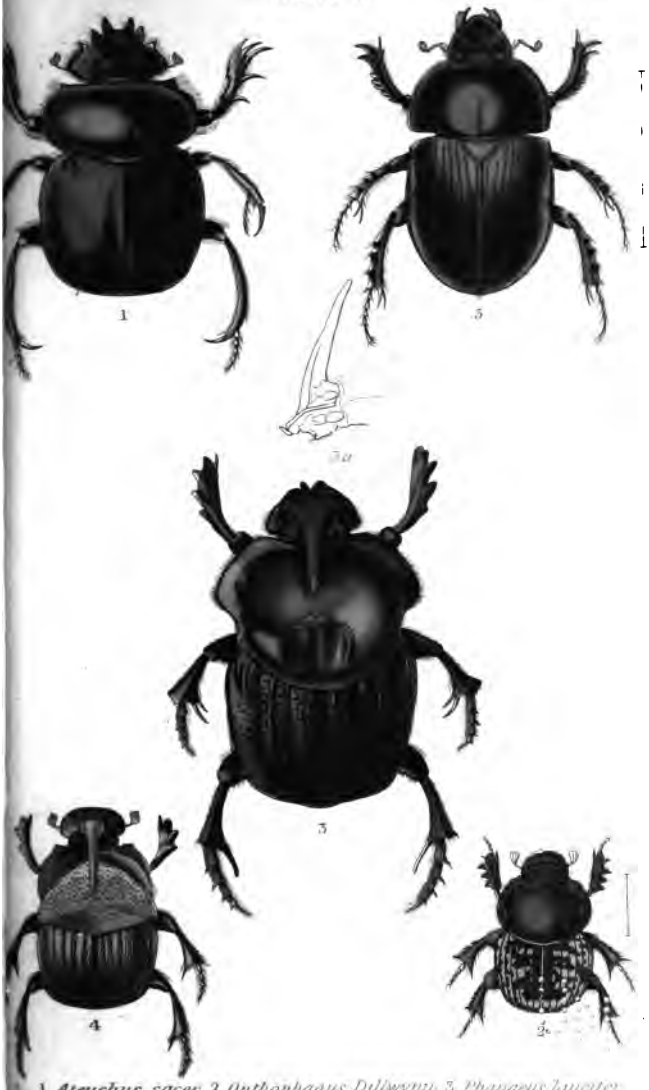
ATEUCHUS SACER.—SACRED EGYPTIAN BEETLE.

PLATE X. Fig. 1.

Scarabæus sacer, *Linn.—Fabricius.—Olivier, Entom.* pl. 8, fig. 59, *a*, *b*.

The colour is entirely black, and the surface ra-

PLATE 10



1. *Ateuchus sacer*. 2. *Onthophagus Dillwynii*. 3. *Phanaeus lancifer*.
4. *Phanaeus Carnifex*. 5. *Geotrupes stercorarius*.

Lizars sc.

ther shining, except the elytra, which are somewhat obscure. The anterior part of the head is rough with shallow punctures, and there are two small approximating tubercles placed in the middle of the forehead between the eyes. The thorax is somewhat convex, marked with numerous minute points anteriorly, and entirely surrounded by a narrow margin, which is crenulated behind. The elytra are usually more obscure than the other parts of the body, and without any other impressions on their surface than a few scattered punctures. The anterior tibiæ are armed with four long teeth on their outer edge, and the posterior pair are slightly bent inwards. All of them are pretty thickly clothed with fine hairs.

This species is very common in all the southern countries of Europe, especially in those that lie along the shores of the Mediterranean. It likewise occurs in the east, and seems to be diffused over all Africa, from Egypt to the Cape of Good Hope.

This renowned insect has been singularly exempted from the obscurity and neglect which have fallen to the lot of most of its tribe. It was one of those "creeping things" to which the Egyptians paid divine honours, and appears to have constituted one of the favourite deities of that remarkable people. If it enjoyed an inferior degree of veneration to the snake-devouring Ibis, it certainly far surpassed in virtue the sacred leeks and onions, from which Juvenal takes occasion to congratulate the nation on account of the number and dignity of its gods:

Porrum et cæpe nefas violare, et frangere morsu.
O sanctas gentes, quibus hæc nascuntur in hortis
Numina!

It was consecrated to the sun, and representations of it are of frequent occurrence in their hieroglyphical writings; it was likewise sculptured on their rings, bracelets, necklaces, and other ornaments, and even enclosed in their coffins along with the embalmed bodies of the dead. As typical of the luminary which is the fountain of light and heat, and the source of all abundance, it came likewise to be regarded as the emblem of fertility; and we are informed by Dr Clarke that it is eaten by the Egyptian women, even at the present day, under the idea that it is of efficacy for this purpose. As natural objects were regarded with religious veneration in Egypt, either in consequence of their being of utility to the inhabitants,* or because they were conceived peculiarly adapted to symbolize some higher nature, and bring it by means of its representative more immediately under the influence of the senses, we are likely to find in one of these causes the reason of this species being raised to such distinguished honours.

Many of the *Scarabæidæ* or larger kinds of dung

* Ipsi qui irridentur Egyptii nullam belluam, nisi ob aliquam utilitatem, quam ex ea caperent, consecraverunt; velut Ibes maximam vim serpentium conficiunt, &c. *Cicero de Nat. Deorum.*

chafers, exhibit some very remarkable instincts in forming a proper nidus or receptacle for their eggs, and providing for the welfare of their progeny. This is witnessed to a certain extent in the common dor or clock (*Geotrupes stercorarius*)—an insect whose "drowsy hum" falls so often on our ear during a walk in the country in the stillness of an autumnal twilight—which digs a cylindrical hole in the earth, often of considerable depth, and conveys a small quantity of dung to the bottom, in which she deposits her eggs. But the habits of the group now under consideration, which is extensively diffused over Africa and the south of Europe, but has no representative in Britain, are greatly more fitted to attract attention. These insects, like our own *Geotrupidæ*, or earth-borers, as the term signifies, likewise deposit their eggs in dung; but each egg is placed in the centre of a small ball or pellet carefully prepared for this purpose. When the pellet is dry, it has generally to be transported to a considerable distance, that it may be buried in a deep hole previously dug for its reception. To a creature so imperfectly provided with members that can be employed as instruments of prehension, the conveyance of an object of some size must obviously be a task of considerable difficulty. Unable to raise the load from the ground, its only resource is to roll it along the surface; but instead of using its head for this purpose, as some birds are said to do when obliged to remove their eggs from one

place to another,* the beetle has recourse to its opposite extremity, and pushes the pellet backwards with the tip of its abdomen and hind legs. When the surface of the ground is unequal the labour is greatly increased; both the beetle and its charge sometimes tumble over a declivity, or it may be seen struggling, like the Sisyphus of heathen mythology, to push its ball to the summit of an eminence that obstructs the line of road. But when an obstacle of this kind occurs to an individual, his associates never fail to hasten to his aid, and their united efforts are generally successful.

The incessant and arduous labour which these insects undergo, led the Egyptian priests to regard them as symbolical of the labours of Osiris or of the Sun. A singular account of them is given by some ancient authors, particularly H. Apollodorus and P. Valerianus. All these Scarabæi, according to the former of these authors, have thirty fingers, corresponding to the number of days which the sun takes to traverse each sign of the zodiac. There are three distinct kinds of them; the first, or scarabæus properly so called, presents the appearance of rays, and has on that account been consecrated to

* We have been assured by an intelligent gamekeeper in the south of Scotland, that he has seen pheasants remove their eggs to a place of safety by rolling them along the ground by means of their head and bill. The same thing has been observed of an Emu or Cassowary kept in the Zoological Gardens in London.

the sun. All the individuals of this scarabæus are of the male sex: when the insect wishes to produce others, it seeks for the dung of cattle, and forms it into a ball—the figure of the world; this it rolls with its hind feet, going backwards, and in the direction from east to west, as the world is so conveyed by its movements. The scarabæus buries this ball in the earth, where it remains concealed for twenty-eight days, a period equal to a lunar revolution, during which the young scarabæus becomes animated. On the 29th day, which the insect knows to be that of the conjunction of the moon with the sun, and of the birth of the world, it opens the ball and throws it into the water. The animals which then issue from it are the scarabæi. It is for these reasons that the Egyptians, when they wish to designate a being produced by itself, or to express the idea of a birth, a father, the world, &c. represent a scarabæus.

The thirty fingers mentioned in the above account are no doubt the joints of the feet or tarsi, which being five to each of the six feet, amount exactly to that number. The rays alluded to are represented by the six teeth or angular projections of the head, a character which is often expressed with great accuracy on the Egyptian monuments and engraved stones. As the male of this species, contrary to what is observed in the generality of coprophagous beetles, scarcely differs in external appearance from the female, and appears to share with

her the labours requisite for the preservation of their race, it is not surprising that the Egyptians, at a period when such erroneous notions prevailed regarding the generation of the lower animals, should have imagined that there was only one sex, and that they should have preferred to consider it as the one which has most privileges attached to it, or, as grammarians call it, the more worthy gender. Admitting the doctrine of spontaneous generation, it was necessary, according to their principles, that the insects should disinter their balls and bring them into contact with water, as that element was conceived to produce, with the concurrence of heat, all those animals that were without living progenitors.*

In more recent times the industrious habits of these little insects appear sometimes to have excited nearly as much admiration as they did in Egypt. In the earliest entomological work published in Britain,† remarkable for the extent of its cumbrous erudition, the species of which we speak, or another closely allied to it, forms one of an extensive series of figures, a few of which bear some resemblance to the objects they are designed to represent, and several folio pages are devoted to

* See an interesting memoir by Latreille, in the *Ann. du Mus.* for 1819, entitled *Des Insectes peints ou sculptés sur les monuments antiques de l'Egypte.*

† Moufeti Insectorum sive minimorum animalium Theatrum, London, 1634.

the exposition of its virtues and uses both to our minds and bodies. This invaluable beetle, according to the author of that work, stimulates us to the acquisition of every good quality; for although nothing but a crust, it yet surpasses us in numerous virtues, and invites us to modesty, temperance, labour, magnanimity, justice, and prudence: "etiamsi nihil sit nisi crustum, variis tamen virtutibus nos vincit, et ad modestiam, temperantiam, laborem, magnanimitatem, justitiam, prudentiamque incitat atque impellit." It teaches us humility by living contented in its stercorareous abodes, and delighting in them more than in the perfume of roses! So fortunate is it in renewing its youth every year, that there can be little doubt that man himself would willingly share in its privileges! It is guilty of no crime in using the dung of animals for its own purposes, since agriculturists and others do the same, and probably were led to the practice by observing the scarabæus! We greatly err if we despise the animal for employing this material; for so highly was it esteemed in ancient times, that, according to the testimony of Macrobius, the term *Sterculeus* was given to Saturn as an honorary cognomen! &c.—The medical virtues of this admirable insect are eulogized in a similar strain, and several recipes are given, which are said to have been of wonderful efficacy.

These insects are frequently alluded to by ancient authors under the various names of *Coprion*, *Can-*

tharus, and *Heliocantharus*. "It should seem from the name," say Messrs Kirby and Spence, "derived from a word signifying an ass, that the Grecian beetle made its pills of *asses'* dung; and this is confirmed by a passage in one of the plays of Aristophanes, the *Irene*, where a beetle of this kind is introduced, on which one of the characters rides to heaven to petition Jupiter for peace. The play begins with one domestic desiring another to feed the cantharus with some bread, who afterwards orders his companion to give him another kind of bread, made of *asses'* dung."*

Various insects of similar habits are found in different quarters of the world, and they form a favourite subject of observation with travellers. One of these abounds in America, where it is known by the name of the Tumble-Dung Beetle. An interesting account of its proceedings is given by a writer on Carolina. "I have attentively admired their industry," he says, "and mutual assisting of each other in rolling their globular balls from the place where they made them to that of their interment, which is usually the distance of some yards, more or less. This they perform breech foremost, by raising their hind parts, and forcing along the ball with their hind feet. Two or three of them are sometimes engaged in trundling one ball, which, from meeting with impediments on account of the unevenness of the

* Intro. to Ent. vol. i. 255, *note*.

ground, is sometimes deserted by them. It is, however, attempted by others with success, unless it happens to roll into some deep hollow or chink, where they are constrained to leave it; but they continue their work by rolling off the next ball in their way. None of them seem to know their own balls, but an equal care for the whole appears to affect all the community. They form these pellets while the dung remains moist, and leave them to harden in the sun before they attempt to roll them. In their moving of them from place to place, both they and the balls may frequently be seen tumbling about over the little eminences that are in their way. They are not, however, easily discouraged; and, by repeating their attempts, usually surmount the difficulties.

"They find out their subsistence by the excellency of their noses, which direct them in their flight to newly fallen dung, on which they immediately go to work, tempering it with a proper mixture of earth. So intent are they always on their employment, that, though handled or otherwise interrupted, they are not to be deterred, but immediately on being freed, persist in their work without any apprehension of danger. They are said to be so exceedingly strong and active as to move about, with the greatest ease, things that are many times their own weight. Dr Birchell was supping one evening in a planter's house of North Carolina, when two of them were conveyed, without his

knowledge, under the candlestick. A few blows were struck on the table, and, to his great surprise, the candlesticks began to move about, apparently without any agency; and his surprise was not much lessened when, on taking one of them up, he discovered that it was only a chafer that moved."*

"An insect of the size of a May-bug," says another writer, evidently in relation to one of these beetles, "is of the greatest utility in so hot a climate; it is the scavenger and dustman of the whole country. It labours with indefatigable industry to collect all the filth that might infest the air, and makes small balls of it, which it hides very deep in holes which it has dug in the earth. It breeds in sufficient numbers to keep the town and the villages clean."†

The next genus which has been selected to illustrate the lamellicorn tribe of beetles is named

ONTHOPHAGUS,

a term that has reference to their habits, being composed of the two Greek words ὄνθος, *dung*, and φαγος, *an eater or consumer*. It consists of a considerable number of species, which are inferior in size to the generality of their dung-devouring confederates, excepting the Aphodii, which form

* Catesby's Carolina.

† Proyart's History of Loango.

such a prominent group in temperate and northern countries, and compensate their want of bulk by the extent of their numbers. The males of several of the Onthophagi are strikingly distinguished by two slender horns rising from the hinder part of the head. One of the most remarkable in this respect has been named *O. Taurus*, from the resemblance these appendages bear, in form and curvature, to the horns of a bull. This will be seen from the annexed figure, which represents a front view of the head.

These insects are common both to the new and old world, and extend from the tropics to the northern temperate zone. Several kinds likewise inhabit New Holland, where, however, they are by no means of frequent occurrence, although they form the principal coprophagous group found in that country. The rarity of these insects in New Holland, as Mr Macleay observes, may be regarded as the natural consequence of that great peculiarity of the Australian continent, namely, the want of all large herbivorous mammalia, except of the marsupial kind. Ten different species occur in Britain, but the southern part of the country seems to be nearly the limit of their extension northwards, as they become rare in the northern counties of England, and we have heard of no instance of their occurrence in Scotland. Like many of their associates, they are ver-

nal insects, and their appearance is agreeable, as indicating the grateful return of spring.

The Onthophagi are known by having the terminal joint of the maxillary palpus attenuated at each end, and truncate—the same joint in the labial pair being somewhat kidney-shaped and truncate; by the short thick body, with the thorax wider than long, and nearly orbicular, with a wide and deep notch in its anterior margin; and by having the contour of the head entire or slightly emarginate. There is no perceptible scutellum. As in the following genus, the four posterior tibiæ are always dilated at their extremities, and nearly in the form of an elongate triangle. The sexes are distinguished by some horn-like process or tubercles, which rise from the head or thorax of the male.

ONTHOPHAGUS DILLWYNII.

PLATE X. FIG. 2.

Onthoph. Dillwynii, *Kirby.—Steph. Illus. of British Entomology*, vol. iii. 174, pl. 18, fig. 6.

This insect is closely allied to the better known species named *O. nuchicornis*. It has been found near Gravesend, and in the neighbourhood of Swansea, by L. W. Dillwyn, Esq. after whom it was named by Dr Leach. It is of a brassy-black colour, and more or less covered with fine short hairs. The thorax is thickly covered with minute granulations,

and there are two tubercles towards the middle, and two others, one on each side, near the margin. The elytra are of a dull greyish yellow thickly clouded with black, and marked with longitudinal lines or striæ. The under parts of the body and legs are black, slightly tinged with a metallic lustre. The male has an elongate, slightly nutant, horn on the hinder part of the head; the female has two elevated cross ridges, which are somewhat arched. The length of the insect is about three or three and a half lines.

The next important genus that presents itself to our notice, was established by Mr Macleay in his valuable work on the lamellicorn Coleoptera, and is named

PHANÆUS.

It is distinguished from all the allied genera, except *Onitis*, by the structure of the antennæ. These organs consist of nine joints, the three last forming a mass of which the basal joint (or the seventh of the whole) is excavated and receives the following one within it, which is partly concealed and nearly of the figure of a horse shoe; the terminal one is small and in the form of a reversed cup. The radical joint of the labial palpi is larger than the others, and dilated on its inner side. There is no apparent scutellum, but a small opening is perceptible at the base of the sutural line, indicating its place. The

thorax is very large, and, like the head, usually presents some sexual differences in the form of its appendages.

The genus comprehends about fifty large and finely coloured species, which belong exclusively to the tropical regions of the new world. They dig holes in the earth in a diagonal direction, sometimes to the depth of two or three feet. They frequent the dung of quadrupeds, and are often observed to fly about in the evening, producing a rather loud noise. The fine species figured is found in Cayenne, and is named

PHANÆUS LANCIFER.

PLATE X. Fig. 3.

Scarabæus lancifer, *Fab.—Linn.—Olivier, Entom.* vol. i. No. 3, pl. 4, fig. 32.

This conspicuous insect is about an inch and a half long, and upwards of an inch broad. The body is very thick and massive, and the half of it at least is occupied by the thorax. The head is black, and armed with a long, recurved, angular horn; the clypeus or anterior portion is furnished with two distinct projecting teeth. The colour of all the upper side, except the head, is a fine violet, with greenish reflections in certain lights, especially on the elytra. The thorax is deeply excavated or concave, and dilated at the sides anteriorly; the hinder

part rises into a broad quadrate prominence, which has its sides reflexed, and a pretty deep notch cut out of the middle of its anterior edge, as if to receive the occipital horn when bent backwards. The elytra are rather deeply furrowed, and rough with transverse elevations and tubercles. The under parts are shining black, slightly tinted with violet, and fringed with short hairs. The anterior tibiæ have four strong teeth on their outer edge.

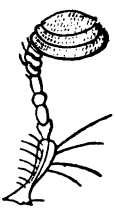
PHANÆUS CARNIFEX.

PLATE X. FIG. 4.

Scarabæus carnifex, *Fab.—Drury's Illus. of Insects*, i. pl. 35, fig. 3, 4, 5.—*Olivier*, i. p. 135, pl. 6, fig. 46, *a*, *b*.

In this finely coloured species the head is of a golden green, and armed with a long slender black horn which is curved backwards. The thorax is large, flattened above, and terminates on each side behind in an acute angle; the sides golden green, the disk bright copper-colour, and rather rough. There is a small impressed mark on each side, rather before the middle. The elytra are of a beautiful green, sometimes glossed with blue; the surface rather rough, and marked with several raised lines. The under side and thighs are brilliant bronzed green; the other parts of the leg black. Found in various countries of North America, in considerable plenty.

The genus GEOTRUPES* has antennæ with the three last joints dilated and transverse, forming a lamellate club, as in the following figure. The



mandibles stand out from the head, and are notched at the apex. The eyes are divided by the margin of the head, and touch the thorax. The latter is as broad as the elytra, and very convex. The elytra are short and oval. Ten different kinds are met with in Britain. That represented is the most common in the northern parts of this country; it is named

GEOTRUPES STERCORARIUS.

PLATE X. FIG. 5.

Scarabæus stercorarius, *Linn.*

It is entirely black above, tinted on the margins with violet or brassy: the thorax is without punctures on the disk, but has a few impressed points towards the sides, and a short line in the middle behind. The elytra are marked with deep striæ, the spaces between which are smooth and somewhat convex. The under side and legs are steel blue, glossed with purple or green in a very beautiful manner.

* Derived from γη, *the earth*, and τρυπαω, *to bore*.

The extensive and very remarkable genus SCARABÆUS is distinguished by having ten joints in the antennæ, the three last forming a foliaceous mass, of which the middle joint is never entirely concealed by the two others—by possessing a distinct scutellum—by the legs being inserted at equal distances—by the upper lip being almost entirely concealed—and by having the mandibles of a hard or horny consistence, and sinuated or dentated on their outer side. The body is usually thick and convex, and often of large size. None of these insects are natives of Britain, and only two appear to inhabit Europe. By far the largest proportion occur in America, particularly in the southern division of that continent, and in the adjacent islands; indeed so numerous are they in these countries, and so remarkable for their size and appearance, that they may be regarded as constituting one of the most distinctive and characteristic features in the entomology of the new continent. The largest kinds are found chiefly in Guiana and the Antilles; a considerable number occur in the vicinity of Rio Janeiro; and they extend in some plenty as far as the 28° of south latitude. Those found in the neighbourhood of Monte-Video, Buenos-Ayres, and Tucuman, are generally of inferior size.

According to M. Lacordaire, who has had many opportunities of observing these insects in their native haunts, the habits of all the species are very much alike. During the day they conceal themselves in

holes dug in the earth or in the decomposed trunks of trees, or they are observed running along the pathways in the woods. On the approach of night they issue from their retreats, and fly around the trees at a considerable height above the ground, producing at the same time a loud noise. It is then that they seem to procure their food; and they are sometimes found in the morning under the leaves or clinging to the branches of trees. Although their flight is dull, it is rather rapid, and can be prolonged for a considerable time. They all produce a shrill noise by rubbing the elytra against the abdomen. The females are in general more common than the males, and are almost always without horns. Among the few exceptions to this rule may be mentioned *S. Pan*, the most common species in Brazil, the female of which has a horn of some size on the head, and an excavation on the thorax. The latter sex is common, while the male is rare.

The first species selected to illustrate this genus is the largest, and in some respects one of the most remarkable that it contains. It is named the Hercules Beetle:—

PLATE II.

Scarabaeus Hercules. male.

Lizars sc.

SCARABÆUS HERCULES.

PLATE XI.

Olivier, i. pl. 1, fig. 1, *a*, *b*, male; pl. 23, fig. 1, *c*, female.—*Drury's Illus.*

The head and thorax of the male are deep black, highly polished, and shining; the former with a long thick horn armed with two or three strong teeth, the latter produced into a very long horn, which is bent downwards near the outer extremity: it bears a strong triangular tooth on each side rather behind the middle, and is densely clothed with reddish-brown pile. The elytra are somewhat glaucous, or of a sea-green colour, but inclining to ash-grey, and marked with scattered spots of black: they are striated and wrinkled across. The under parts of the body and the legs are black; the anterior tibiæ armed with three strong spines externally.

Found in greatest plenty in the Antilles and Guiana; it extends as far as Rio Janeiro, but becomes very rare in that neighbourhood. It likewise occurs in the American islands.

SCARABÆUS TITYUS.

PLATE XII.

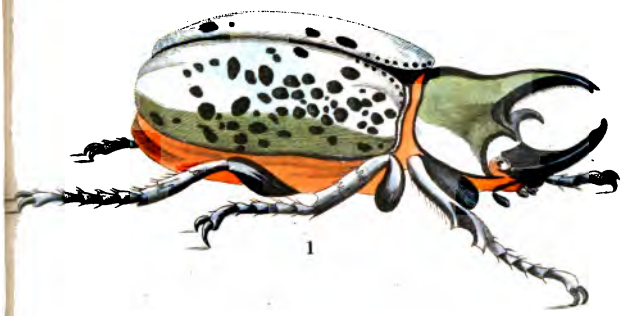
Linn. Syst. Nat. p. 542.—*Olivier*, i. No. 3, p. 9, pl. 4, fig. 31, and pl. 10, fig. 31, *b*, *c*.—*Say's American Entom.* i.

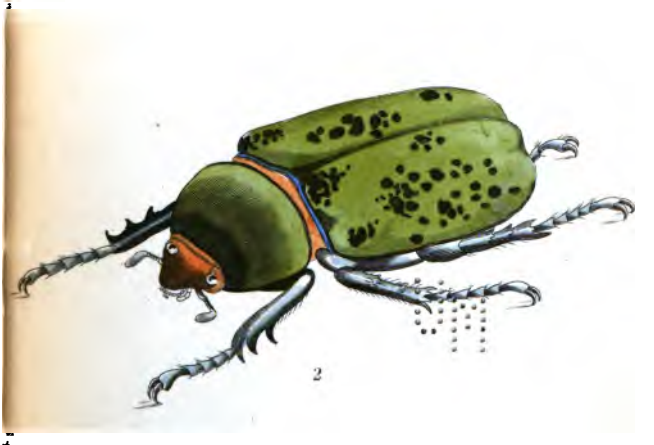
This insect is about two inches in length: the prevailing colour glaucous, inclining to grey. The head is black, and armed with a strong horn which is curved backwards. The thorax is variegated with black and grey, and has three horns projecting from its anterior part, one in the centre slightly curved downwards and hairy on the under side, and two lateral ones which are short and acute. Elytra glaucous-grey, with numerous large spots of black. The under side of the body, and legs, are wholly black.

The female is without horns, and differs from the other sex in the colour of the elytra.

Inhabits Carolina, Virginia, and other North American states. "It is so extremely rare in Pennsylvania," says Mr Say, from whose handsome work on American Entomology the accompanying figures have been taken, "that the late Rev. F. V. Melsheimer, the parent of Entomology in this country, and a very industrious collector, found but two individuals in eighteen years. An instance has however occurred, in which the appearance of a considerable number of them occasioned no little

PLATE 12.





Scarabaeus Tityus.
1. male 2. female.

Luzars sc.

PLATE 13.

Neptunides Atlas

surprise in the neighbourhood where they were discovered. A mile or two south of Philadelphia, and near the river Delaware, an old cherry-tree was blown down by a violent current of wind, and my informant saw the remains of numerous individuals, in and about the cavity of the tree laid open by the shock of its fall. That there might be no mistake, he exhibited the thorax of a male he had chosen from the mutilated fragments. I think it highly probable that the *Tityus* is more especially a native of the southern states, as my friend Mr J. Williams presented me with several specimens in high preservation, collected by himself in Maryland, and from them the drawings for the annexed plate were made."

SCARABÆUS ATLAS.

PLATE XIII.

Linn. Syst. Nat. p. 542.—*Fabricii Syst. Entom.* p. 8.—Scarabæus Hector ? *Dejean.*

This very singular and conspicuous insect is entirely of a black colour, tinted with greenish bronze, especially on the elytra, the whole surface being smooth and glossy. The head is armed with a very long acute horn, which is slightly recurved, and has a double row of serratures on its inner side. Two similar horns project, one from each side of the thorax, which are without teeth, acute at the tip, and

slightly curved towards each other. From the anterior part of the thorax, immediately over the head, there issues a short triangular horn, which is directed forwards. The scutellum is very large and triangular; the elytra are smooth and shining; and the under side of the body, and legs, black. The anterior tibiæ have three acute teeth on their outer edge towards the apex.

It is a native of Java, where it is considered rare, although we have seen six or eight specimens in a single collection of insects from that country. It likewise occurs, but much less frequently, on the continent of Asia, the individual figured having been taken at Rangoon in India.

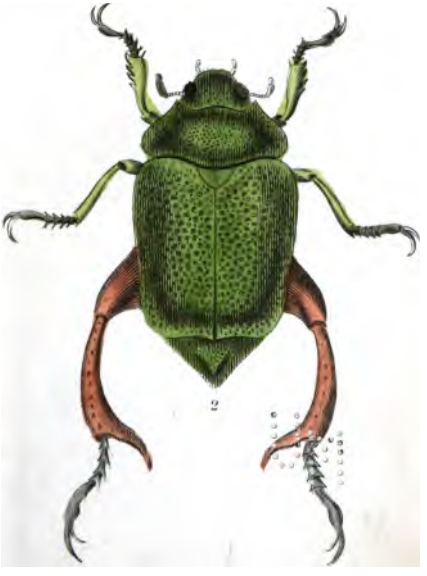
SCARABÆUS MACROPUS.

PLATE XIV. Fig. 1.

Kanguroo beetle, *Shaw's Naturalist's Miscellany*, cccLxxx. 4.

This very remarkable-looking insect was first made known to the public by Mr Francillon, who is supposed to have received it from South America. The individual which he described appears to be the only one that has occurred, and it is now said to be preserved in the rich cabinet of Mr Macleay. Until the discovery of the insect next to be described, there was no lamellicorn beetle that bore much resemblance to it; but that species partakes in some measure of its peculiar characters. Of

PLATE 14.



1. *Scarabaeus macropus.* 2. *Chrysophora chrysochlora.* Lizars

these, the most singular are the length of the hinder legs, and the extraordinary thickness of the thighs, which exceeds any thing that is observed in such as exhibit a structure of this kind. The whole of the upper surface is smooth, and of a bright green colour, and the under side is golden yellow and copper coloured. The antennæ and tarsi are brownish black.

CHRYSOPHORA CHRYSOCHLORA.

PLATE XIV. Fig. 2.

Melolontha chrysochlora, *Latr.—Voy. de MM. Humb. et Bonpl.* ii. 15, 1 *fem.* 2 *male.*

Latreille assigns as the distinguishing marks of this genus, which was first proposed by Count Dejean, the great size of the hinder legs, the thickened hinder thighs, and the curved tibiæ, which terminate in a strong projecting point at the internal angle. It contains only two or three species, of which that above referred to is the most remarkable. It was discovered by MM. Humboldt and Bonpland in Peru. It is of a brilliant green on the upper side, but on the under parts of the body coppery red is the prevailing hue. The thighs and posterior tibiæ are of the latter colour; and the tarsi, which have the joint that bears the claws very large and club-shaped, are brownish. The elytra are thickly covered with large excavated points, but the head

and thorax are comparatively smooth. The female is much smaller, and the hinder thighs are not so thick as in the male. Like the common Cockchafer, this species lives in society, and was sometimes observed in great numbers by the distinguished travellers who first brought it to Europe.

RUTELA PULCHELLA.

PLATE XV. Fig. 1.

Kirby, Linn. Trans. xii. p. 405, pl. 21, fig. 10.

This genus includes such insects as have the hinder thighs scarcely differing in the two sexes; the scutellum rather small, and the pointed process of the sternum short, and not reaching to the insertion of the forelegs. The terminal joint of the maxillary palpus is large and ovate. The body is of an oval form. The species given as an illustration of this generic group is a native of Brazil. It is about eight lines and a half in length, of a fine yellow colour inclining to green. The thorax is green in the middle, and yellow on the sides and anterior edge. The elytra are thickly covered with small punctures, which have a tendency to form lines: the colour is yellow, with the region of the scutellum, and a curved band behind the middle, green.

PLATE 15.

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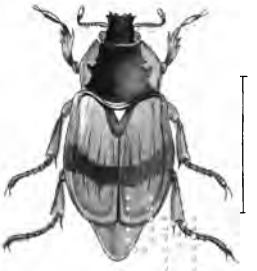


1

1. *Ruttela pulchella*. 3. *Melolontha Fullo*. *male*
2. *Macraspis fucata*. 4. *female*.

MACRASPIS FUCATA.

PLATE XV. FIG. 2.

Cetonia fucata, *Fabr.*—Cetonia quadrivittata, *Olivier.*

The most obvious character in this genus is that which has suggested the name,* viz. the great size of the scutellum, which equals at least a third of that of the elytra. The projecting point of the sternum reaches to the insertion of the anterior legs, and in many instances extends beyond that point. The form of the body is in general shorter and more rounded than in Rutela. The species amount to near thirty, and they are confined to the tropical regions of the New World. The most common in the interior of Brazil is *M. clavata*, which is often observed in the morning, suspended in great numbers to the leaves of trees, around which they fly during the day, and consume the flowers. The species figured has the same habits, but it is much rarer, and appears later in the year. It is about ten lines in length, of a deep black colour, very highly polished on the surface, and thickly covered with very minute punctures. The thorax is margined with deep yellow, and there are two broad stripes of the same colour on each wing-case, which unite behind.

* From *μακρος*, *long*, and *ασπις*, *a shield*.

MELOLONTHA FULLO.

PLATE XV. Fig. 3 and 4.

Scarabæus Fullo, *Linn.*—*Donovan's Brit. Insects*, iv. pl. 112.

The genus Melolontha,* of which the common Cockchafer affords a familiar example, has antennæ consisting of ten joints, with five or seven of the uppermost produced into thin leaflets in the male, while in the females only four (sometimes six) are a little produced. All the claws are of equal size, and terminate in a simple point, with a small tooth on the under side near the base. As constituted by the older Entomologists, it formed a very extensive genus; but in its present restricted acceptation, it scarcely includes more than a dozen species. Of these, by far the most common is M. vulgaris (*common Cockchafer*), which occurs abundantly in many parts of England, Ireland, and the Continent, but is comparatively rare in Scotland.† The perfect insect

* The term is derived from *μηλεα, an apple-tree*, and *ἀνθησις, a flowering or inflorescence*, because the insects it anciently denoted, either were supposed to be produced from the flowers of fruit-trees, or were accustomed to resort to them for food.

† The common cockchafer sometimes abounds in Dumfriesshire: many hundreds of the grubs were turned up while digging the foundation of the Mansion-house of Jardine Hall.—Ed.

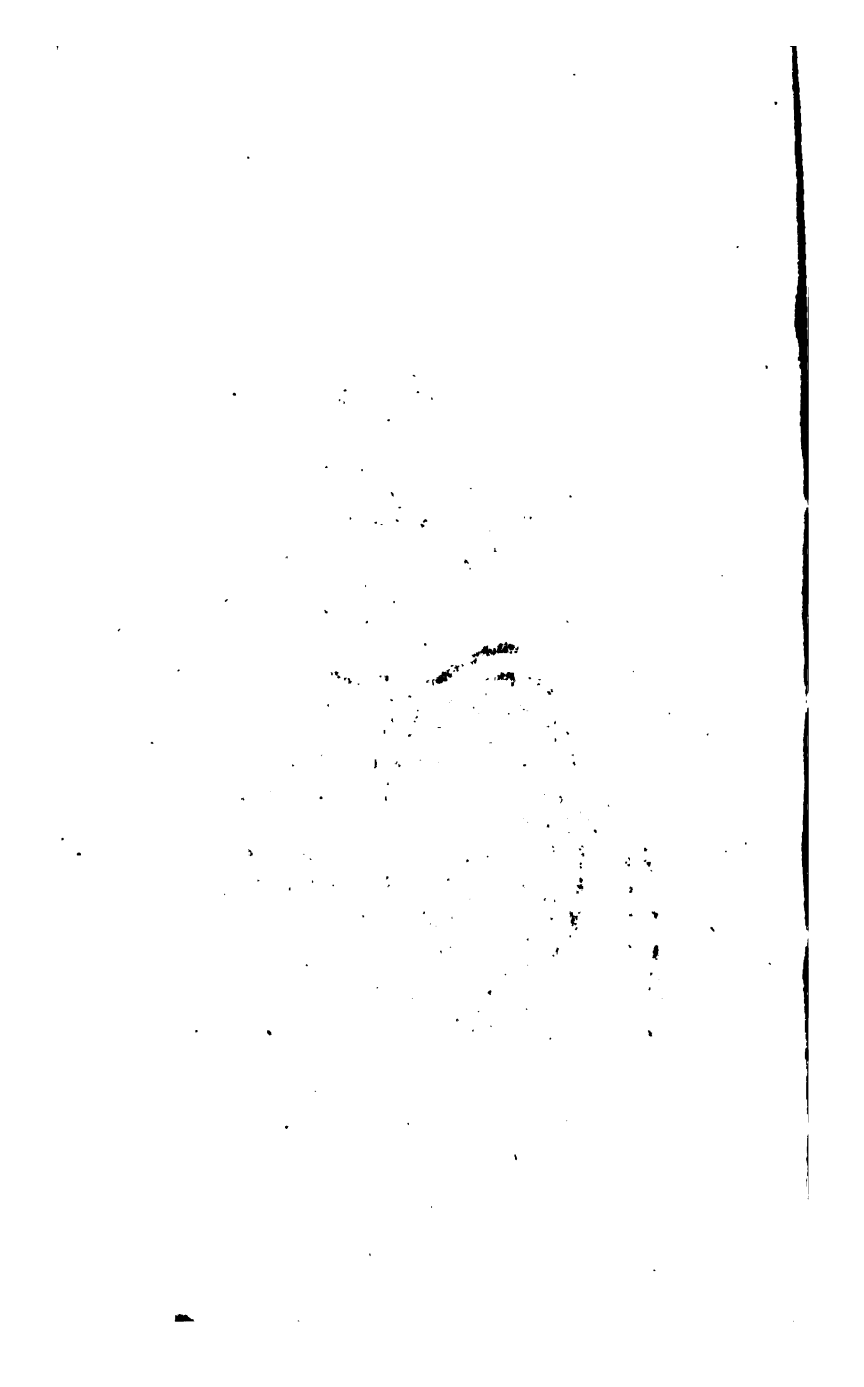
subsists on the leaves of trees, but in the state of grub it consumes the roots of grass and other herbaceous plants. Its ravages, both in the early and final stage of its life, have often been described, and are unhappily better known than any efficient remedy of easy application. The beautiful species represented (fig. 3, male; fig. 4, female) is either not of such destructive propensities, or, what is more probable, too limited in numbers to accomplish much mischief. In this country especially, it is of very rare occurrence, and as the few examples that have occurred were generally found on the seashore, it has been questioned whether its appearance ought not to be ascribed to accidental causes, rather than to its being strictly a native of this country. It is nearly an inch and a half in length, of a dark-brown colour, having the whole upper surface irregularly marked with patches and spots of white. There is a pretty regular line of white down the middle of the thorax, and another, less regular, on each side of it. The antennæ and legs are reddish brown. It is found occasionally in France, and in the more southern countries of Europe.

GOLIATHUS MAGNUS.

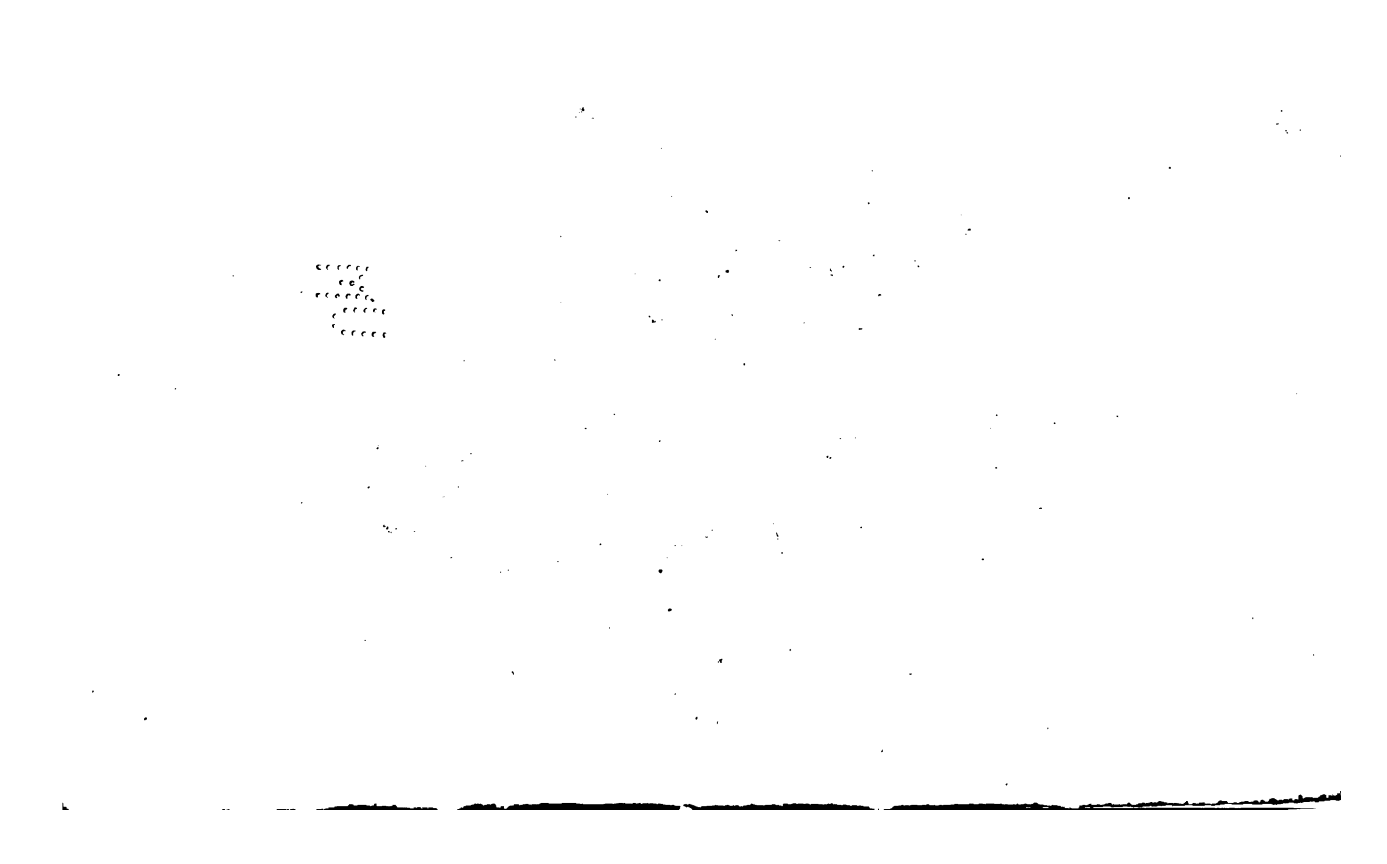
PLATE XVI.

Cetonia goliata, *Fabr.*—Cetonia Goliathus, *Olivier*, i. No. 6, pl. 5, fig. 33.—*Drury's Illustrations*, i. pl. 31.

This genus, which was established by Lamarck, contains a few very large and striking species belonging to the family Cetonidæ. The most obvious mark by which it may be recognised is the anterior part of the head, which is dilated and divided into two broad divergent lobes in front, in the form of obtuse or truncated horns; and there are two smaller lateral ones near the middle of the head. The thorax approaches to orbicular, but is somewhat narrowed in front. Of the species represented, the only specimen with which we are acquainted is that preserved in the Hunterian Museum, Glasgow. It was found on the west coast of Africa, and is probably the same from which Olivier and Drury made their drawings. The latter states that the insect which he figured was found floating dead in the river Gaboon, opposite Prince's Island, near the equinoctial line. The antennæ and head are nearly black, but the surface of the latter is thickly covered with whitish scales. The thorax is dark brown, with the sides dirty white, and five broad waved lines of the same colour along the disk, the two lateral ones uniting with the white margin. The ely-



Goliathus magnificus.



tra are reddish brown, with a streak of white across the base: the scutellum is likewise margined with white, and has a narrow patch of the same down the middle. The under side and thighs are black, with a mixture of green; the other parts of the leg are black.

Many of the most ornamental of the lamellicorn beetles are arranged in the extensive genus Cetonia, and others closely allied, which have recently been separated from it. The true Cetoniæ present the following characters:—body nearly ovate, rather obtuse behind, the back somewhat depressed: thorax gradually widening towards the hinder margin, which forms the base of a triangle with the apex truncated: scutellum distinct: mentum never transverse, and more or less emarginate in the middle of its upper edge: terminal lobe of the maxillæ ending in a tuft of fine hair. In the perfect state, these insects feed on vegetable juices and the honey of flowers. Rösel informs us that he kept the species known in this country by the name of Rosechafer alive for upwards of three years, by feeding it with fruit and moistened white bread. The species are numerous, amounting to upwards of 130, and in many of them, as Mr Macleay has remarked, nothing can exceed the beauty and lustre of the polish, or the admirable variety of ornament, with which their elytra are adorned. They occur in almost every country, except in the colder parts of the temperate zone, and the regions verging towards the poles.

Only two are known to inhabit Britain, and these may almost be said to be confined to the southern division of the island; for although the most common (*C. aurata*) has been noticed in Scotland, its occurrence is extremely rare. A few fine species inhabit the south of France and the eastern countries of Europe, and a considerable number are found in America, particularly in Mexico. They are rather scarce, however, in Brazil, and such as are found there do not seem to multiply to the same extent as they do in most other places. Java and the East Indies are likewise rich in these insects, and the former contains a generic group (*Macronota*, Weid.) very nearly related to the true Cetoniæ, which is peculiar to the country. But their metropolis, or characteristic locality, appears to be the southern parts of Africa, in the neighbourhood of the Cape of Good Hope. New Holland also produces several beautifully marked species.

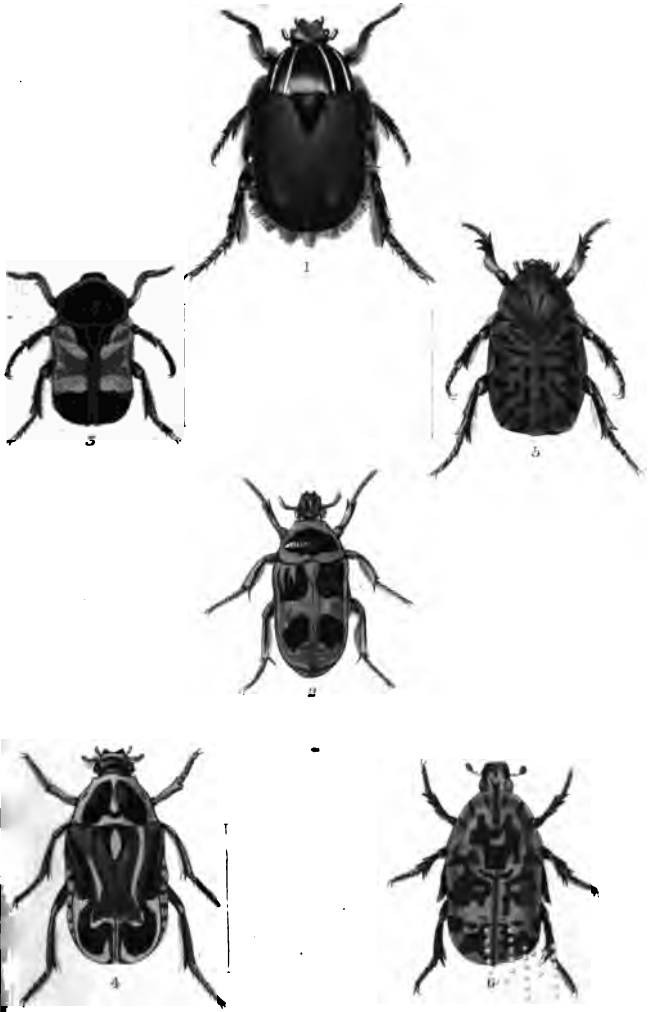
CETONIA FASCICULARIS.

PLATE XVII. Fig. 1.

Scarabæus fascicularis, *Linn.*—*Drury's Illus.* pl. 33, fig. 2.—*Olivier*, ii. No. 6, pl. 11, fig. 108.

The head, scutellum, and thorax of this beautiful insect are deep black and shining: the latter with four deeply impressed longitudinal lines, which are filled with very minute white scales. The elytra

PLATE IX.



1. *Cetonia fascicularis*. 2. *Cetonia Macleayi*. 3. *Cetonia discoidea*.
4. ——— *Australasiae*. 5. *Gymnetis nervosa*. 6. *Gymnetis marmorea*.

are of a fine deep green, not shining, the surface somewhat rough and corrugated. The under side of the body is thickly clothed with tawny hairs, disposed in tufts round the sides of the abdomen. The legs are black. It is a native of the Cape of Good Hope.

CETONIA MACLEAYI.

PLATE XVII. Fig. 2.

Kirby, Linn. Trans. xii. p. 408, pl. 21, fig. 11.

This insect is depressed, very smooth and shining, of a golden green, approaching to emerald green. The head and antennæ are black, and the thorax has a large discoidal spot of the same colour, which is narrowed in front. The elytra have a large quadrate spot of black on each side of the scutellum, and there are two others towards the apex which nearly meet and form a broad band. The tibiæ and tarsi are of a chestnut colour, and the segments of the abdomen are margined with black.

"This beautiful insect," says Mr Kirby, in the paper above referred to, which has supplied us with the annexed figure, "was brought from Manilla by Mr Simon Davidson, Surgeon in the Royal Navy, who purchased several of them in a shop, where its elytra, and those of some splendid *Buprestes*, were sold as ornaments for ladies head-dresses."

CETONIA DISCOIDEA.

PLATE XVII. Fig. 3.

Cetonia velutina, *Olivier*, ii. pl. 12, fig. 114.

The length of this species is between seven and eight lines. The head, thorax, and scutellum are velvet black, and unspotted. The elytra are likewise velvet black, with the whole of the base red, except the region of the scutellum; the outer margin is of the latter colour from the shoulder to a little beyond the middle, where there is a broad band of red interrupted at the suture. The under parts and legs are shining black. It is found at the Cape of Good Hope.

CETONIA AUSTRALASIÆ.

PLATE XVII. Fig. 4.

Schyzorhina Australasiæ, *Kirby.—Dejean's Catal.*

This curiously marked species is a native of New Holland. The surface is depressed, and remarkably smooth and glossy. The anterior part of the head is yellow, with two small spots of black. The head from before the eyes, and the thorax, are black; the latter having a stripe of yellow running along the sides and front, a line of the same down the middle, and an arched stripe across the base,

which is not united with the others: there is a small spot of black in the yellow margin before the middle. The scutellum is black, with an oblong patch of yellow. The elytra are deep chestnut-red, approaching to black at the apex, with two curved lines of yellow down the middle of each, which are attenuated behind, and generally united to a cross stripe of the same colour, from the suture: there is also a stripe of yellow round the hinder margin of each wing-case, which terminates before the middle, where it is dilated into a triangular spot with the apex directed inwards. The under side is black, curiously variegated with yellow. The legs are chestnut-red, the hinder thighs striped with yellow.

GYMNETIS NERVOSA.

PLATE XVII. Fig. 5.

This genus is easily distinguished from Cetonia, by having the thorax produced in the middle behind into an angle which occupies the place of the scutellum. About fifty different kinds are known, by far the greater part of which belong to tropical America. The species named *nervosa* is entirely of a reddish-brown colour, having the upper surface variegated with linear and angular patches of black. The under side and legs are black.

GYMNETIS MARMOREA.

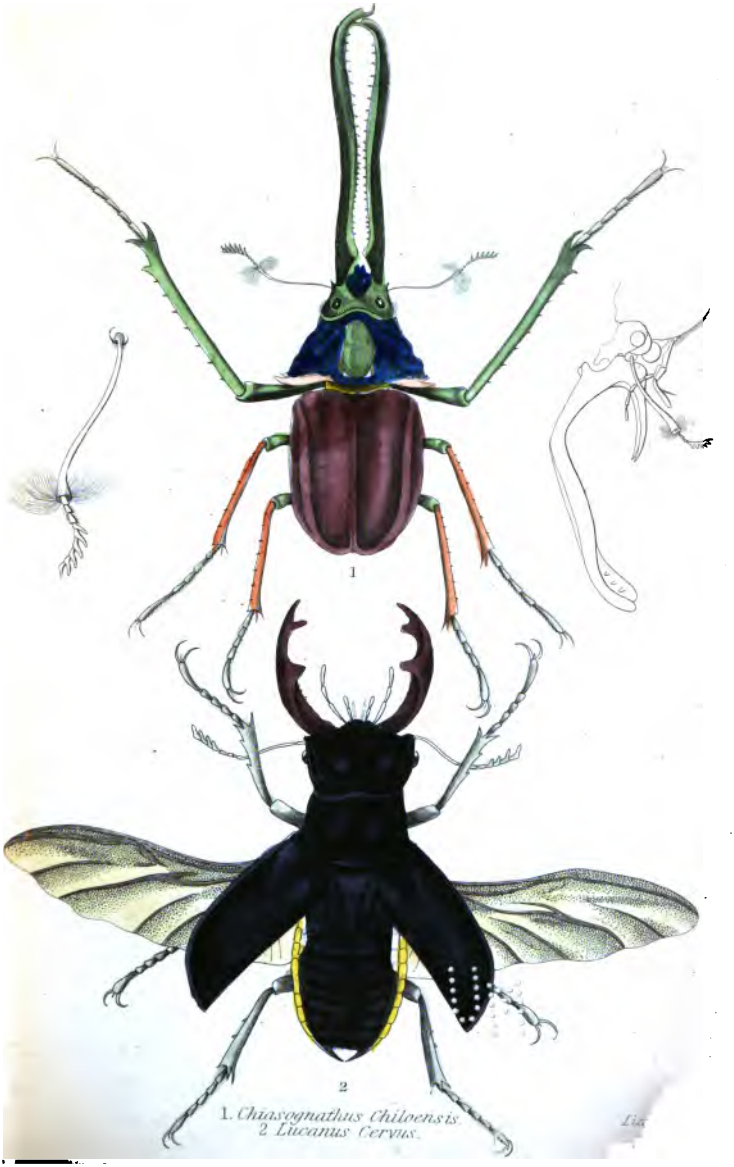
PLATE XVII. Fig. 6.

Cetonia marmorea, *Olivier*, ii. pl. 2, fig. 110.

The prevailing colour is fine yellow, the surface polished and shining. The whole body is variegated with black markings, arranged in a manner somewhat similar to those in the preceding species, but having a greater tendency to run together and form patches. The under parts of the body, and the legs, are deep black and very glossy. It is a native of Brazil.

Having now illustrated at considerable length the first tribe or principal division of the lamellicornes, we shall proceed to give some examples of the second, which corresponds, as was already mentioned, to the genus Lucanus of Linnæus. The LUCANIDÆ have ten-jointed antennæ, the club or thickened portion of which consists of long teeth or leaflets arranged on an axis in the manner of a comb (Plate XVIII. *left-hand fig.*). The mandibles are usually of very large size in the male, and furnished with strong teeth, which renders their appearance rather more formidable than that of most other beetles. The tarsi terminate in two simple claws, having two strong bristles placed between them.

PLATE 18



1. *Chiasognathus Chiloensis.*
2. *Lucanus Cervus.*

CHIASOGNATHUS CHILOENSIS.

PLATE XVIII. Fig. 1.

Tetrophthalma chiloensis, *Lesson's Illus. de Zoologie*, pl. 24. —Chiasognathus Grantii? *Cambridge Phil. Trans.* iv. pl. 9 and 10.

This singular genus is characterised by the length of the mandibles, which equals or exceeds that of the whole body, and by the extraordinary elongation of the lowest joint of the antennæ, which is ornamented with a tuft of hairs at its tip. It was established by Mr Stephens on an insect received from the island of Chiloe, and its characters published in the Cambridge Philosophical Transactions for 1831.* More recently M. Lesson has figured an insect which obviously belongs to the same genus, although he has thought proper to distinguish it by a new name. Indeed it is extremely probable that it is the same species as that described by Mr Stephens; but as it differs in a few minute particulars, it will be better in the mean time to retain its distinctive name. Lesson's insect is represented by the accompanying figure. The mandibles are bronzed green; the head violet blue; the thorax

* The generic name refers to the form of the mandibles, which are incurved at the tip, and cross over each other, being derived from *χιαζω, to lie crosswise*, and *γναθος, the jaw*

green, with coppery and violet-blue reflections on the sides; the elytra bright chestnut red; the legs green, with the under side of the thighs reddish. As with other lucanideous insects, its food consists of the flowing sap of trees, and it is said to frequent the *araucarias* and other green trees in the island of Chiloe.

LUCANUS CERVUS, OR STAG BEETLE.

PLATE XVIII. FIG. 2.

Donovan's Brit. Insects, i. pl. 13.—Lucanus inermis, *Don.* xii. pl. 400.—*Marsham's Entom. Brit.*

In this genus the four terminal joints of the antennæ are produced on one side; the eyes are not divided by the margin of the head; the latter is as wide as the thorax, and in some instances wider; and the maxillæ terminate in a slender lobe without corneous teeth. The species figured is the well-known Stag-beetle of this country. It occurs in considerable plenty in several of the southern counties, but has not been observed in the north of England, nor in Scotland. It is likewise found on the Continent, and the larva is considered by some to be the *Cossus* of the ancient Romans, which is described as a white worm living in the interior of oak trees, and which was much coveted as a delicious food by these refined epicures. The male is about two inches in length, including the mandibles. It is

entirely of a brownish-black colour, the surface shining and thickly covered with small punctures. The female is considerably less, the mandibles are quite short, and the head is proportionally much smaller.

"I believe it has been supposed by several writers," says Mr Waterhouse, "that the mandibles of the stag-beetle are designed for perforating the bark of trees, and thus causing the sap to flow, on which the insect is said to feed; but I do not recollect ever seeing this confirmed on positive authority. During the past summer I kept a stag-beetle alive for several weeks: I allowed him to bite my finger with his mandibles, which he did with great strength and perseverance for some seconds; and immediately, on relaxing his hold, applied alternately one of his antennæ, and the galea of his maxillæ, to the indentation, as if to ascertain whether any moisture was flowing from the wound. The stag-beetle has a small patch of golden coloured hair near the base of the fore leg, the use of which, I believe, has never been pointed out;—it is evidently for the purpose of cleaning the antennæ, which, after touching saccharine fluids, become sticky. The insect does this in the most adroit manner, bending back the antenna and placing it beneath the leg, and then drawing it out slowly. The specimen which I had became after a time tame and playful, sometimes amusing himself by tossing about a ball of cotton with his horns. He

was very fond of sugar moistened, and the juice of raspberries."*

The second primary section of the order Coleoptera, as established on the number of joints in the tarsi, includes all the kinds which have five articulations in the first four tarsi, and four in the hindmost pair; it is named

HETEROMERA.†

As an example of this section, we shall first mention the genus Horia, of which the characters are so distinct that it forms a tribe by itself. It is easily known by the structure of the claws, which are deeply serrated on the under side, and each of them accompanied by a long narrow appendage, as represented by the adjoining figure. The mandibles are strong, and stand out from the head. The palpi are filiform, and the thorax is square.

* Entomological Magazine, No. 6, p. 59.

† From ἑτερος, *different*, and μερος, *a joint*.

PLATE 19.

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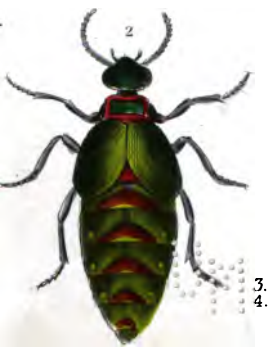


2

1. *Horia maculata.*
2. *Meloe variegatus.*
3. *Cantharis vesicatoria.*
4. ——— *Nuttalli*

Lizars sc.

HORIA MACULATA.

PLATE XIX. Fig. 1.

It is about sixteen lines in length, of a uniform reddish-yellow colour, with seven spots of black on each wing-case, six of which are arranged in pairs, and the seventh occupies the apex. The mandibles and antennæ are shining black, and the legs are of the same colour, except the base of the thighs, which is the same as the body. According to the observations of Lansdown Guilding, this insect deposits its eggs in the nest of the carpenter-bees (chiefly in that of *Xylocopa Teredo*), and when the larvæ are excluded, they consume the food which the bee provides for its proper offspring. It is not rare in the vicinity of Rio Janeiro and other parts of tropical America, and is usually found under the bark of trees. It moves but slowly both when walking and flying, and when handled emits a yellowish liquid from its mouth of a peculiar odour.

MELOE VARIEGATUS.

PLATE XIX. Fig. 2, Female.

Donovan, ii. pl. 67.—*Linn. Trans.* xi. 37, pl. 6, fig. 1, 2.—Meloe scabrosus, *Marsham.*—M. mayalis, *Olivier.*

This and the following genera are two of the most

conspicuous in the tribe of CANTHARIDÆ, or blistering beetles, many of which are so much celebrated for their vesicatory properties. The group is well distinguished by the hooks of the tarsi, which are so deeply divided that they appear double. The present genus is destitute of wings, and the elytra are of an oval or triangular form, the one overlapping the other at the base, and they diverge widely from each other at the tip. They leave a considerable portion of the abdomen uncovered, especially in the female, which has that part of the body unusually large. The most singular circumstance in the natural history of these insects, is the supposed parasitical nature of the larvæ, which are said to adhere to the bodies of flies and bees, and to live upon their juices, which they extract by suction. But the observations on which this opinion is founded are far too inconclusive to establish its truth. They are characteristic of European countries, the greater number occurring in Spain and Britain. Among the latter is the species figured, which is of a brassy lustre, variegated with tints of purple and violet. The thorax and elytra are dark copper colour, glossed on the sides with violet; the former covered with punctures, and the latter with small tubercles which often run together and make the surface rough. The abdomen is likewise rough; the colour dark green, with the hinder margin of the segments coppery and violescent. The under side is golden colour and purple; the legs black, inclining

to violet. It is the most beautiful of the genus, and is found in the South of England, but not frequently. The most common species is M. proscarabæus.

CANTHARIS VESICATORIA, OR BLISTER BEETLE.

PLATE XIX. FIG. 3.

Meloe vesicatorius, *Linn.*—Lytta vesicatoria, *Fab.*

This is the well-known Blister-beetle, or Spanish fly. It is entirely of a golden green, with the antennæ black. The head has a deeply impressed line in the middle behind, and the surface of the thorax is rather unequal. The elytra are corrugated like the surface of a piece of leather, and two or three raised longitudinal lines are observable on each. The length is from six to ten lines. According to Latreille, they appear in France about the period of the summer solstice, and are found in greatest abundance on the ash and lilac, on the leaves of which they feed. In Spain, where they are rather more plentiful than in other parts of Europe, they are usually collected for commercial purposes in the month of June, when they assemble in order to pair. They are shaken from the branches of the shrubs which they frequent, and received in sheets spread on the ground. They are killed by being held in hair sieves over the fumes of vinegar,

and afterwards dried, either by exposure to the sun, or by being placed on hurdles covered with cloth or paper in a well-ventilated apartment. The blistering property has been ascertained to reside in a peculiar principle, on which chemists have bestowed the name of *Cantharadine*.

CANTHARIS NUTTALLI.

PLATE XIX. Fig. 4.

Lytta Nuttalli, *Say's American Entomology.*

Head and thorax deep green tinted with golden yellow, the latter with unequal scattered punctures, a longitudinal line in the middle, and another across the base. The elytra are deep red or purple with a golden gloss, the surface rough; having two slightly elevated lines along the disk of each, and another near the margin. The under parts of the body are bright green, the legs, antennæ, and palpi nearly black.

"This noble species," says the American Entomologist, to whom we have been indebted for the accompanying figure, "which far surpasses the far-famed *Vesicatoria*, has, I understand, been labelled in a British cabinet with the name I have here adopted, in honour of Mr Thomas Nuttall, who discovered it. It seems to be limited to the western region. In company with Major Long, I observed

it, for the first time, near the base of the Rocky Mountains. A very numerous flock had there taken possession of the few diminutive bushes that occurred within the space of a hundred yards, every spray of which was burdened with their numbers. After passing this limited district, not an individual was seen during the remainder of the journey. On the recent expedition of the same officer to the river St Peter, I obtained but a single specimen, which was found one evening at an encampment in the North-West Territory."

The next primary division of this order contains all beetles which have four joints in each foot, and is accordingly named

TETRAMERA.

An extensive family of this division have the head elongated into a kind of snout or beak; these constituted the Linnæan genus Curculio, and in this country are named *weevils*. They are very numerous, amounting to nearly three thousand. They invariably feed on vegetable substances, and many of them commit much injury to the produce of our fields and gardens. The genus APODERUS is distinguished by the length of the neck, which is united to the thorax by a kind of rotula. The rostrum is

short and thick, and somewhat widened at the extremity. The species are generally of small size, but many of them are ornamented with agreeable colours.

APODERUS LONGICOLLIS.

PLATE XX. Fig. 1.

Olivier, v. No. 81, pl. 1, fig. 25.—Attelabus longicollis, *Fabr. Syst. Eleuth.*

The ordinary length is between four and five lines. The colour of the upper parts of the body is reddish yellow, the under side of a paler hue. The neck is remarkably long, and brownish black. The elytra are very convex behind, marked with punctured lines, and numerous impressed points of a considerable size. It is found in the East Indies.

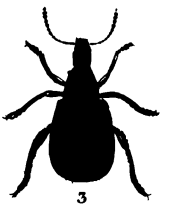
APODERUS GEMMATUS.

PLATE XX. Fig. 2.

Olivier, v. No. 81, pl. 1, fig. 16.—Attelabus gemmatus, *Fabr.*

The figure in the accompanying plate represents this insect considerably enlarged, its natural length seldom exceeding three lines. The colour is rust-red inclining to yellow, the antennæ black. The thorax and elytra are pretty thickly covered with

PLATE 20



1. *Apoderus longicollis.*
2. *geminatus.*
3. *ruficollis.*

Lizars sc.

4. *Rhynchites Populi.*
5. *pubescens.*
6. *Collaris.*

black tubercles, of which several of those on the elytra are rounded, and arranged in rows. The under side and legs are pale yellow. It occurs in the vicinity of the Cape of Good Hope.

APODERUS RUFICOLLIS.

PLATE XX. Fig. 3.

Olivier, v. No. 81, pl. 1, fig. 15.—Attelabus ruficollis, *Fabr. Spec. Insect.*

The head of this species, which is said to be a native of Siberia, is reddish in front and black behind; the antennæ are of the latter colour, with the base red. The thorax is red and unspotted. The elytra are smooth and shining, of a fine blue, faintly marked with punctures which form indistinct lines. The under side of the abdomen is black, with the margin reddish. The legs are of the latter colour. It is between two and three lines long.

In the genus RHYNCHITES the head is inserted into the thorax as far as the eyes, and the rostrum is a little enlarged at the extremity. The abdomen is nearly square. About seventeen different kinds inhabit Britain, and many of these are insects of great beauty, especially R. Bacchus, which is found chiefly in the county of Kent.

RHYNCHITES POPULI.

PLATE XX. Fig. 4.

Curculio populi, *Linn. Degeer.*—Attelabus populi, *Fabr.*

In this well-known species the body is smooth and shining, of a golden-green or bluish tint on the upper side, and dark violet colour beneath; the antennæ and tarsi black. The elytra are rather irregularly punctured. In one of the sexes there is an acute spine on each side of the thorax, projecting forwards. The ordinary length of the insect is nearly three lines. It is found on poplar and birch trees, in England and on the Continent of Europe.

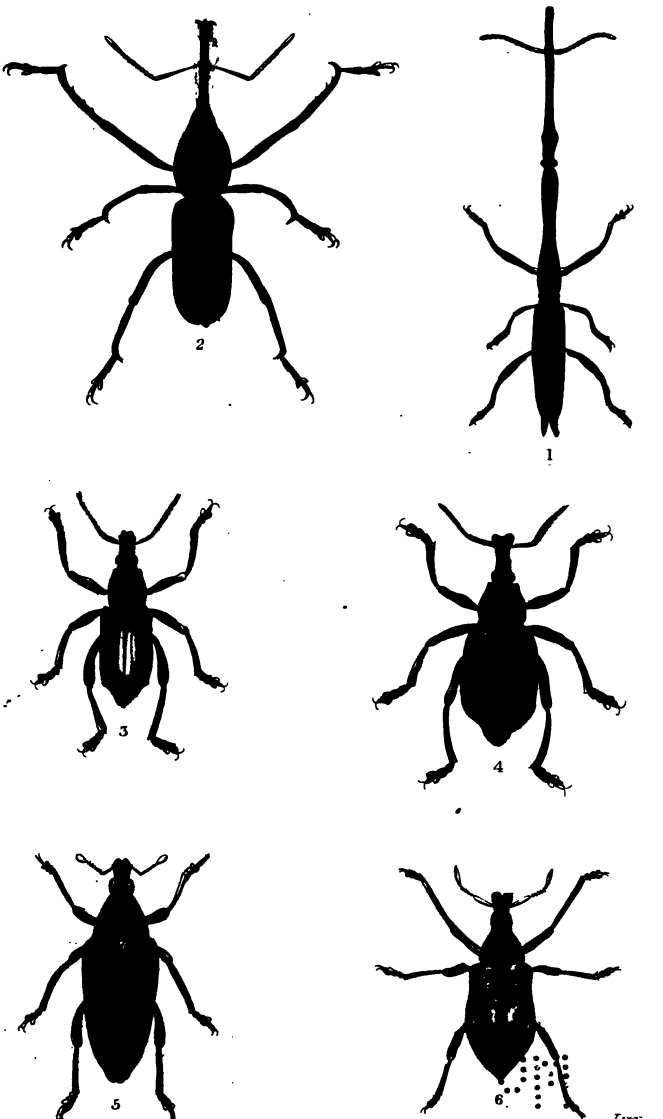
RHYNCHITES PUBESCENS.

PLATE XX. Fig. 5.

Attelabus pubescens, *Fabr.*

The body is rather more elongate in proportion to its breadth than in the preceding species. The whole body is of a deep violet colour, and clothed with rather long hairs. The snout is shorter than the thorax, and, together with the antennæ, black. The elytra are marked with regular punctured lines. The legs are the same colour as the body, but the tarsi are black. Length three lines. It inhabits France, Germany, and England.

PLATE 21.



1. *Brentus ancharago*. 2. *Rhina barbirostris*. 3. *Curculio Cuvierii*. 4. *Curculio Geoffroyii*. 5. *Curculio vittatus*. 6. *Curculio sphacelatus*.

RHYNCHITES COLLARIS.

PLATE XX. Fig. 6.

Antribus collaris, *Fabr. Syst. Eleuth.*

The body of this small insect is covered with short pubescence: the snout is rather long, depressed at the apex, and of a black colour, as well as the antennæ. The thorax is very smooth, and reddish: the elytra deep blue, pretty regularly striated: the under side and legs black. Found in Carolina.

The very remarkable genus BRENTUS has filiform antennæ, occasionally with the last joint thickened —the rostrum very long and advanced—the whole body unusually narrow, and the penultimate joint of the tarsi bilobed.

BRENTUS ANCHORAGO.

PLATE XXI. Fig. 1.

Curculio Anchorago, *Linn.—Degeer, Mem. Insect.* v. 273.

Body very narrow and elongate, shining black; the markings differing a little in the two sexes. In the male the head has a groove in front, which is wanting in the female. In the latter the thorax is somewhat contracted in the middle, and in both sexes it has a groove extending from the middle to

the base. The elytra are scarcely wider than the base of the thorax, deeply grooved near the suture, and marked with punctured lines on the sides, each of them with two narrow lines of reddish yellow. The anterior thighs are furnished with a small tooth on the under side. Like all the other species of the genus, this insect lives under bark, and is often found on the stems of old trees congregated in hundreds.

RHINA BARBIROSTRIS.

PLATE XXI. Fig. 2.

Latreille, Hist. Nat. des Crust. et des Ins. 11, p. 102.—Curculio barbirostris, *Fabr.*

The species given as an example of this genus—which may be briefly characterised by the elongate shape of the terminal joint of the antennæ, and the length of the fore legs—is found at the Cape of Good Hope. It is entirely of a black colour, except the hairs on the rostrum, which are reddish yellow. The rostrum or snout is longer than the thorax, trifid at the point, and tuberculated above. The thorax is rough with deeply impressed punctures, and bears yellowish hairs on the sides and beneath. The elytra are marked with closely placed lines of deep square punctures, the spaces between which have a few short hairs. The anterior legs are much longer than the others, and all the tibiæ are armed with a few remote spines.

Although now much restricted in its application, the genus CURCULIO still contains a great variety of species. In all of them the penultimate joint of the tarsi is deeply bilobed, and the antennæ are composed of eleven joints, of which the three last form a club. The grooves on the sides of the rostrum, for receiving the antennæ, are oblique, and converge towards each other on the under side. Many of the species are of large size, and such as frequent the foliage of trees are often adorned in the most sumptuous manner. This is particularly the case with several South American kinds, which are covered with a coating of scales of the most sparkling brilliancy, equal to the "illumination of all gems." These are accordingly highly prized by collectors, a single specimen of *C. regalis* having been once sold at Paris for L.23 sterling. The British weevils that present most analogy to these favoured creatures belong to the genera Phyllobius and Polydrusus; but though of great beauty, their comparatively small size renders them less striking.

CURCULIO CUVIERII.

PLATE XXI. FIG. 3.

Geonemus Cuvierii, *Guerin, Voyage de la Coquille.*

Of a fine green colour, with a stripe of black down the middle of the rostrum and thorax. The elytra are suddenly narrowed at the apex, and have

a band of black in the centre of each, which does not reach the extremity. The under side and legs are green.

CURCULIO GEOFFROYII.

PLATE XXI. FIG. 4.

Geonemus Geoffroyii, *Voyage de la Coquille.*

Brilliant green, glossed with violet. The rostrum has a narrow impressed line down the middle, and there is a similar one in the centre of the thorax. The elytra are striated, and marked with four cross bands of deep black, of which the second from the base and that next the apex are abbreviated, and the third dilated on each side of the suture. This and the preceding species were obtained in a recent French voyage of discovery round the world.

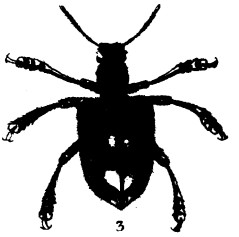
CURCULIO VITTATUS.

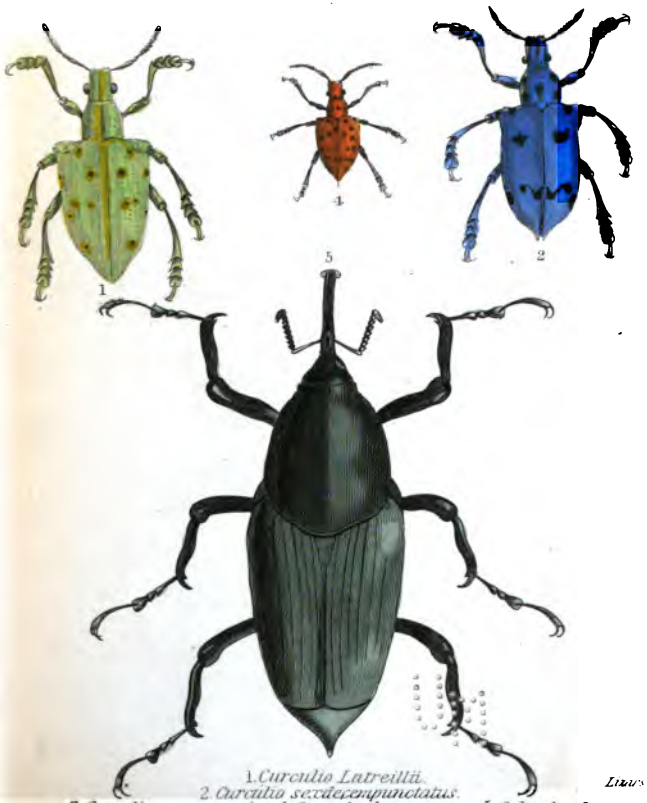
PLATE XXI. FIG. 5.

Fabricius, Ent. Syst.—Linn. Syst. Nat.

Rostrum and thorax black, the surface smooth and shining: elytra with punctured lines, a broad white stripe at the side of the suture, a broader one of a red colour in the middle of each, and a third narrower than the others, towards the outer margin: the apex greyish: the legs and belly black;

PLATE 22.





1. *Curculio Latreillii.*
2. *Curculio sexdecempunctatus.*
3. *Curculio myrmosarius.* 4. *Curculio brunneus.* 5. *Calandra heros*

Lizars sc

the sides of the latter white or greenish. The longitudinal stripes vary considerably in tint; the central one is generally rose-colour, and the outer one is frequently greenish. The insect occurs in Jamaica, and others of the West Indian islands.

CURCULIO SPHACELATUS.

PLATE XXI. Fig. 6.

Herbst. Coleopt., vi. pl. 67, fig. 12.—*Olivier*, v. No. 83, pl. 20, fig. 253.

The antennæ, rostrum, and thorax, are black; the latter, with the sides and four spots on the back, white. The elytra are likewise black, irregularly punctured, and marked with two or three spots, composed of yellowish scales, which are very irregular both in form and colour, often running together and forming large patches. The body beneath, and the legs, are black, more or less covered with white scales. Found in St Domingo, and elsewhere.

CURCULIO LATREILLII.

PLATE XXII. Fig. 1.

Cyphus Latreillii, *Schænherr.*

This beautiful insect is entirely of a light green glossed with golden yellow, and of great brilliancy.

The thorax has a groove down the middle. The elytra are prominent at the shoulders, marked with punctured lines, and having several rounded tubercles which are brownish or golden-yellow. It is a native of Brazil, and, like most of its brilliant allies, is invariably found on trees, principally those of the genus *Mimosa*. It is named in honour of the celebrated French entomologist.

CURCULIO SEXDECIMPUNCTATUS.

PLATE XXII. Fig. 2.

Linn. Syst. Nat. p. 618, No. 92.—*Fabr. Ent. Syst.*

The whole body is of a fine blue, a colour very seldom observed in this tribe. The thorax is generally marked with four, sometimes with five black spots, and there are six others on each wing-case, of which two at the suture, a little behind the middle, are somewhat crescent-shaped and united. The under side is blue spotted with black; the antennæ are of the latter colour. A native of South America.

CURCULIO MYRMOSARIUS.

PLATE XXII. Fig. 3.

Rhigus myrmosarius, *Schœnherr.*

Black, densely clothed with long black hair. Head and thorax unspotted; elytra with a streak

across the base, and several large spots of reddish yellow on each, two of which approximate at the suture, a little behind the middle, and form a heart-shaped spot. Legs brownish. It is found in South America.

CURCULIO BRUNNEUS.

PLATE XXII. Fig. 4.

The body of this insect, which belongs to the modern genus Rhigus, is entirely reddish brown, and marked with numerous small black spots. The elytra are acute at the apex, and the legs are black. Not having met with any description which could be regarded as applying to this species, we have distinguished it by the above specific name. It was received from Brazil.

The genus Calandra is known by its nine-jointed antennæ, inserted at the base of the rostrum, with the two last joints forming a mass. It contains many conspicuous insects, several of which have attracted the attention of agriculturists by the injury they occasion to corn and other vegetables. The best known in Europe is *C. granaria*, one of the smallest of the genus, the larva of which takes up its abode in the interior of a grain of corn, and speedily consumes it. Many large and remarkable kinds are found in tropical countries, where they dwell by preference in the interior of monocotyle-

donous plants. The most common is *C. Palmarum*, of which the larva, known by the name of *ver-palmiste*, is esteemed a delicious food. It is so abundant in Guiana, that shortly after a palm-tree is cut down, especially the *Maripa* palm, which furnishes the *chou-palmiste*, of which a great quantity is consumed in the colony, crowds of these insects may be seen collected upon its stem, and occupied in penetrating into its interior.* The species represented is rather larger than the Palm-weevil, and is named

CALANDRA HEROS.

PLATE XXII. Fig. 5.

Fabr.—Olivier, v. No. 83, pl. 28, fig. 410.

The rostrum is black and cylindrical, with a small recurved piece on each side at the apex. The thorax is brownish black, clothed with a velvety pubescence. The elytra are likewise velvety, but of a browner hue than the thorax, much shorter than the abdomen, and slightly striated on the surface. The under parts of the body, and the legs, are black, the anterior tibiæ somewhat curved on the interior edge. It inhabits the East Indies.

* Lacordaire.

LONGICORNES.

One of the most extensive and important families of the tetramerous section has received the above name, on account of the great length of the antennæ. Many of the species are of large size, and otherwise remarkable for their forms and habits. The larger and typical kinds are found only in the interminable forests of the tropics, where they frequent the oldest and largest trees. The larvæ live in the interior of the stems, which they perforate in all directions, and hasten the process of decay. In that state they resemble a large white worm, which is destitute of feet, but is furnished with means of locomotion much better adapted to the habits of animals which pass their lives in cylindrical excavations not much exceeding their own bodies in width. The upper and under sides of most of the segments are covered with small prominences or asperities. When the insect wishes to advance, it contracts its body by bringing the two extremities towards each other, and, fixing its hinder end to the walls of its hole by means of these asperities, it extends the anterior part of its body forwards. This operation is repeated at each successive advancement. When the larva has attained its full size, it forms a large cocoon, composed chiefly of saw-dust and gnawed portions of wood, in which it changes into a chrysalis. Before assuming that state, it

never fails to approach the mouth of its hole, that there may be no obstacle to the development and escape of the perfect beetle, which is of much larger size than the larva, and not furnished with instruments of equal efficiency for penetrating wood.*

These insects lay a considerable number of eggs, which they deposit in the crevices and fissures of trees. They are of an oblong form, and usually of a dirty-yellow colour. Those of some of the larger species are nearly equal in size to the eggs of many of the smaller birds. The following figure on the left represents those of *P. giganteus;* but as the specimens from which they are taken have been long preserved, they have no doubt shrunk considerably from their original dimensions.

Like the generality of insects that deposit their eggs in holes and narrow fissures, into which the extremity of the body could not readily be introduced, the female Prioni are provided with an instrument which issues from the terminal segment of the abdomen, and forms a canal along which the egg slides in security to the place destined for its reception. This instrument is of a horny consistence, and generally bears a few small teeth or angular projections at the point on the outer side, which

* Olivier's Entom. iv. p. 4.

PLATE 23

Prionus Cervicornis.

Linn.s sc.

probably serve to render it more steady by adhering to the substance into which it is inserted. The right-hand figure represents this ovipositor as it appears in *P. armillatus*.

The largest and most striking of these insects compose the genus PRIONUS. Their antennæ are longer than the head and thorax, and sometimes serrated or pectinated; whence the generic name, from πριων, *a saw*. The terminal lobe of the maxillæ is as long as the first two joints of the palpi, and the body is depressed, with the thorax square and spined or dentate on its edges.

PRIONUS CERVICORNIS.

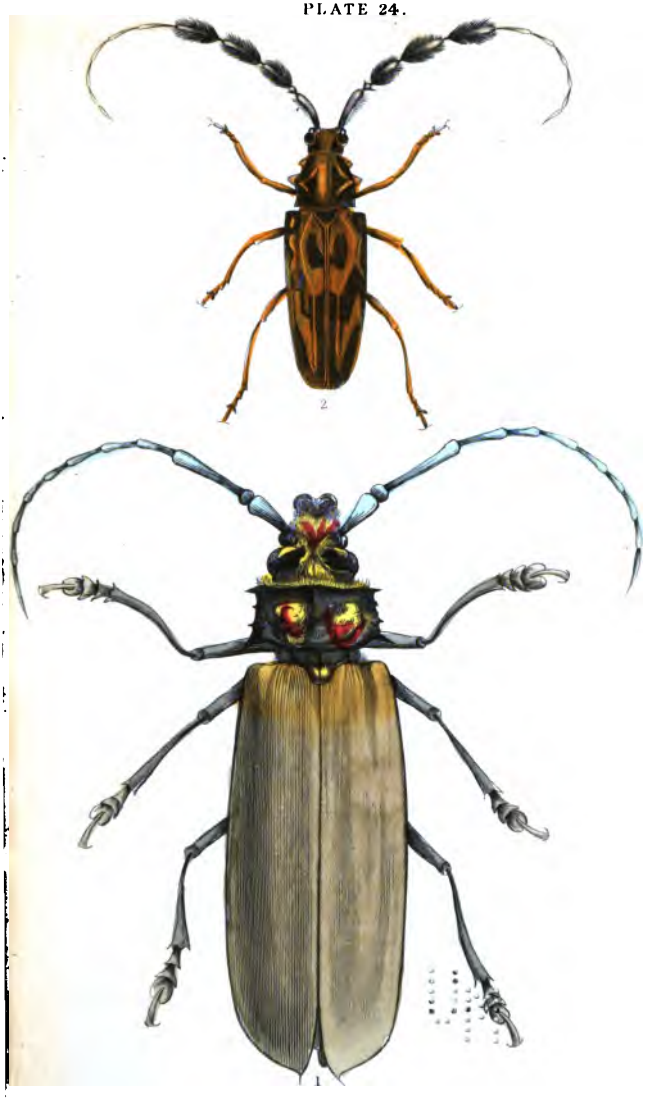
PLATE XXIII.

Olivier, 66, pl. 2, fig. 8, *a*, *b*.—Cerambyx cervicornis, *Linn.*—*Merian. Surin.* pl. 48.—Macrodontia cervicornis, *Lepel. et Serv.*

Although this insect is surpassed in size by one or two other species of Prioni, it is the most remarkable of the larger kinds, owing to its conspicuous projecting mandibles, and the curious markings of the elytra. The prevailing colour of the head and thorax is rust-brown; the former bears two elevated longitudinal lines, and the latter has three strong acute spines on each side, the two anterior ones being rather remote from each other, and the margin between them dentate. The mandibles of-

ten exceed the length both of the head and thorax; they are strong, and bent towards each other, especially at the tip; their internal edge is deeply serrated, and one of the teeth near the middle is considerably longer than the rest: they have likewise a strong tooth or salient angle on the outer edge towards the anterior extremity. The elytra are dark brown, variegated with numerous longitudinal stripes of reddish yellow, which are often interrupted, and united with each other. The under parts of the body, and the legs, are of a ferruginous colour; and the latter are without spines. This species varies much in size, some of the specimens which we have seen measuring upwards of five inches, while others do not exceed two and three quarters. It is an inhabitant of Brazil and Cayenne, where it is universally known by the name of *Mouche scieur de long*. This appellation refers to a very peculiar habit which the insect is recorded to practise. It is said to seize a branch of a tree or shrub between its long and powerful mandibles, and to fly round the enclosed twig till it has succeeded in sawing it off. "Although I have not myself been a witness of this occurrence," says M. Lacordaire, "I am inclined to believe it, both because I have been assured of its truth by individuals worthy of credit, and because I have seen on several occasions branches cut in the manner alluded to, and bearing the evident marks of mandibles which must have belonged to an insect of the size of this species." A like prac-

PLATE 24.



1. *Prionus corticinus.* 2. *Lophonocerus barbicornis.*

Lizars sc

tice has been noticed in a large species of *Oncyderes* found in Brazil; and it is conjectured that similar observations will soon be made in relation to others of the long-horned beetles. The larva of *P. cervicornis* is said to live in the wood of the Gossampinus, and is frequently used as an article of food.

PRIONUS CORTICINUS.

PLATE XXIV. Fig. 1.

The body of this species is rather depressed. The head and antennæ are brown, the former having a deep furrow between the eyes, and a dense tuft of hair in front covering the base of the mandibles. The thorax is brown, having a few tubercles in the middle, and several spines on the sides, of which that next the hinder angle is longest. The elytra are elongate, and nearly of equal width throughout their whole length; they are of a brown colour, and have a small spine at the apex of each. The under side of the body, and the legs, are brown. It is a native of Cayenne.

The tribe of *Cerambycidæ* bears a considerable resemblance to the preceding in the general appearance of the body; but they differ in having mandibles of ordinary size, and nearly alike in the two sexes. The eyes are notched on the inner side, and partly surround the base of the antennæ;—and

the latter are at least as long as the body. The upper lip is very large, and occupies the anterior portion of the head. This tribe is of great extent, but a very small proportion of the species occur in Britain, their characteristic localities being in warm countries. They are much esteemed by collectors for their handsome proportions, and the beautiful combination of colours with which many are adorned. Some are remarkable for emitting a strong odour of roses, especially that named *moschatus*, which occurs in considerable abundance on willow-trees in the vicinity of London. In *C. phyllopus*, a native of Brazil, this scent is so strong that it is felt in walking through the woods to a great distance. They are usually found in woods and on the trunks of trees, being very rarely seen on flowers, and they appear to derive their chief nourishment from the sap that exudes from the stems. The species figured as an example of this tribe is named

LOPHONOCERUS BARBICORNIS.

PLATE XXIV. Fig. 2.

Cerambyx barbicornis, *Olivier*, iv. No. 67, pl. 7, fig. 48.—*Linn. Fab.*

This genus is chiefly distinguished by the circumstance from which it derives its name,* viz. the

* From λοφος, *a tuft*, and κερας, *a horn*.

fascicles or tufts of hair with which several of the intermediate joints of the antennæ are garnished. The species represented has the five lowest joints thickly clothed with these hairs, which are of a black colour; the apex of the joints and the six naked ones at the extremity are yellow. The head and thorax are also yellow, the latter having a few spots of black on the sides, which are armed with a strong spine and several tubercles. The elytra are variegated with black and reddish yellow. The middle of the abdomen is yellow, and the legs are entirely of that colour. It is a native of Cayenne, and not of Asia, as erroneously stated by Linnæus and Fabricius.

The next important tribe of the long-horned beetles that presents itself to our notice, is that named LAMIARIÆ, in which the head is nearly vertical, the palpi almost filiform, and terminating in an oval joint, which tapers to a point. The outer lobe of the under jaws is narrowed at the extremity, and curved upon the inner one. The most remarkable insect belonging to the tribe is that named

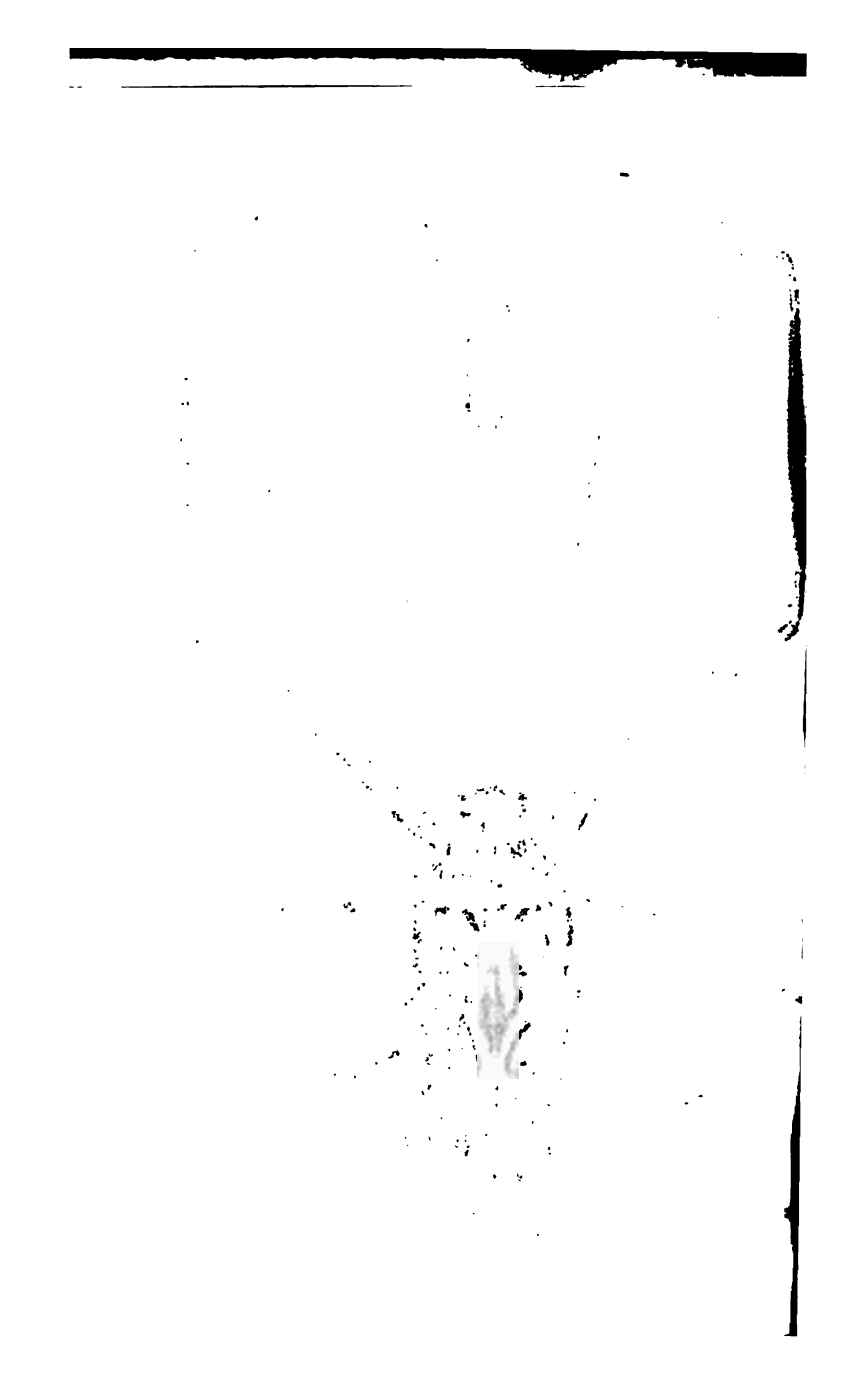
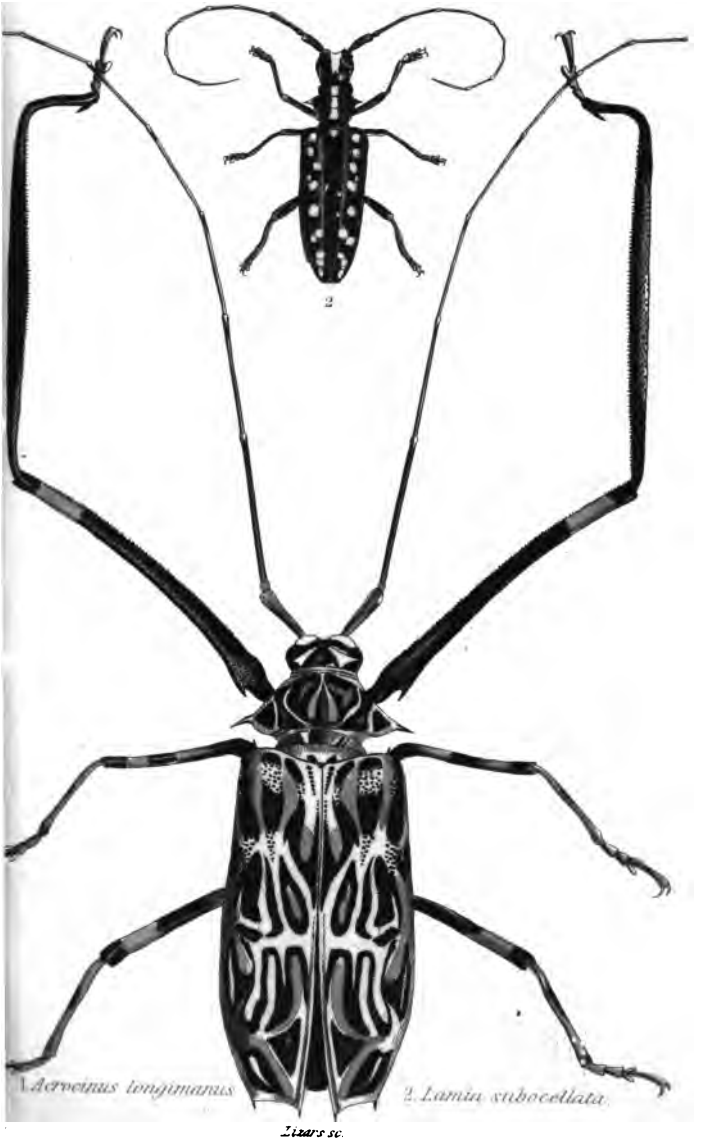


PLATE 25.



Lizars sc.

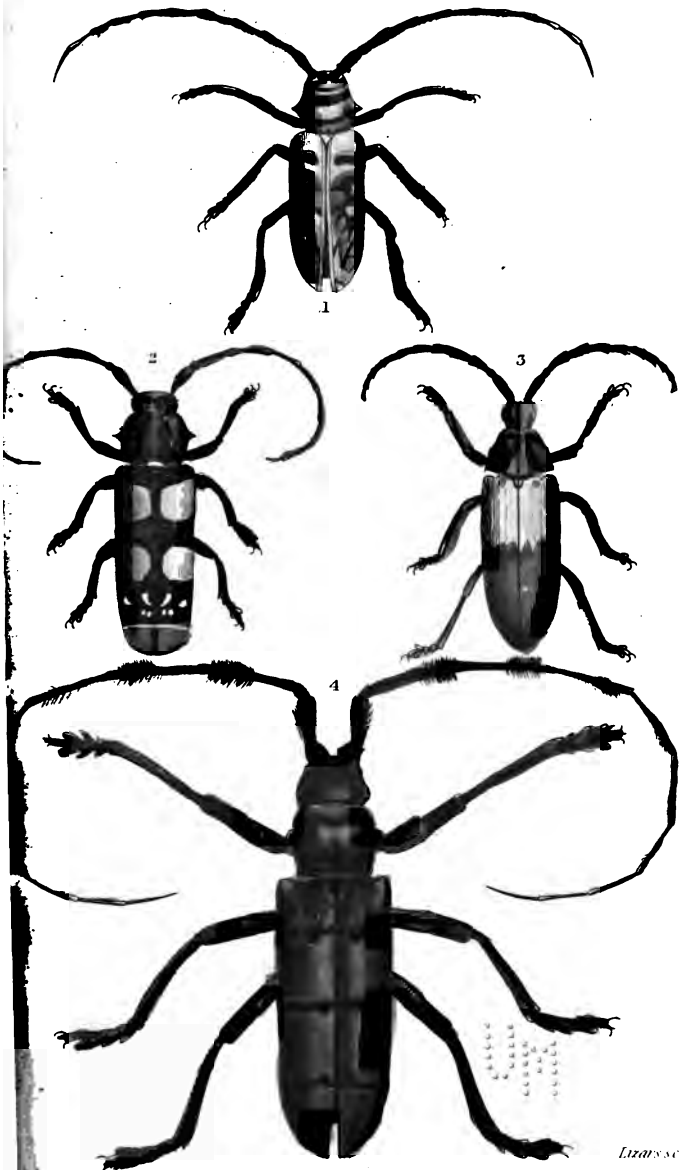
is greyish. The head is ornamented with two triangular patches of red, and two lines of the same hue are placed in the centre of the thorax, which converge in front: from each side of the thorax behind there projects a strong spine, which can be moved in different directions at the will of the insect; and two others, of small size, and incapable of motion, issue from the back, one towards each side. The elytra are variegated with undulated lines and angular figures of red and grey: towards the base the surface is pretty thickly covered with impressed points, interspersed with small black shining tubercles; and each elytron bears an acute spine on the shoulder, and two others at the hinder extremity. The under parts are likewise covered with silky pubescence, but it is of a grey colour. The thighs are smooth and black, each of them surrounded by a red ring near the apex. The anterior thighs and tibiæ are of great length, the latter much incurved at the tip, where they are armed with a spine, and covered with small points and granulations on the under side; these parts in the other legs are smooth, and more or less ash-coloured. This insect is of frequent occurrence in Brazil, Guiana, and other tropical countries of America. It is known to the natives by the name of *Mouche bagasse*, a term taken from a tree which has lately been described under the botanical appellation of *Bagassa Guyanensis*. The wood of this tree is of a bright yellow, and when it is felled, there issues from it a white viscid juice of

a peculiar and penetrating odour, of which the insects are so fond that they seldom fail to be attracted by it. The negroes, who often employ themselves in searching for the rarer and more beautiful kinds of insects, that they may dispose of them to collectors, avail themselves of this propensity, and sometimes cut down these trees, as the most ready means of obtaining a supply of beetles. It is generally found on the trunk or at the bottom of trees, rarely under the bark, and never on the leaves. Its motions are so sluggish, that it may be said to drag itself along rather than walk. It occasionally takes wing on the approach of evening, but its flight is slow and unsteady, scarcely appearing under the guidance of the animal, as it strikes against any object that happens to be in the way, and falls to the ground. A rustling sound accompanies its flight, and it often betrays its retreat by a rather loud noise, which is produced by the friction of the thorax. It varies greatly in size and colour. Specimens from the interior of the country are usually of a much paler tint than such as are obtained in the neighbourhood of Rio Janeiro, and other places towards the coast.*

The genus Lamia, from which the present tribe derives its name, is constituted by a variety of finely-coloured species, some of which are of considerable size. They are extensively diffused over the earth,

* Anal. des Sciences Naturelles, tom. xxi. 180.

PLATE 26.



Lizars sc

Lamia ornata. 2 Lamia formosa 3, Desmocerus cyaneus. 4 Lamia tricincta.

and a considerable number occur in Europe. Only two kinds appear to inhabit Britain.

LAMIA SUBOCELLATA.

PLATE XXV. Fig. 2.

Cerambyx subocellatus, *Olivier*, iv. No. 67, p. 69, pl. 2, fig. 12, *a*, *b*.

The colour of the body is brownish black, and it is covered with dense silky pubescence. A broad stripe of yellowish white runs along the middle of the head, and is continued down the centre of the thorax; the latter is armed with an acute spine on each side. The elytra are marked with numerous rounded spots of yellowish white, which are variable in size. We received the specimen figured from Brazil.

LAMIA ORNATA.

PLATE XXVI. Fig. 1.

Cerambyx ornatus, *Olivier*, iv. No. 67, pl. 4, fig. 24, *a*, *b*.

The head of this pretty insect is golden yellow, glossed with green about the eyes, and having two black lines anteriorly. The thorax is of the same colour as the head, and has two narrow cross bands of black: the hinder margin green. The elytra are yellow, marked with regular patches of black

which are surrounded with green; the suture and hinder extremity of the elytra are of the latter colour. The middle of the abdomen and the legs are glossed with green. It is said to be a native of Africa.

LAMIA FORMOSA.

PLATE XXVI. Fig. 2.

Olivier, iv. No. 67, pl. 20, fig. 153.

In this insect the head is black, with the front rust-red, the thorax black, having a large red spot on each side; the elytra are likewise black, with two broad bands of red interrupted at the suture, and a few white punctures towards the hinder extremity, which is itself red. The legs are black, spotted with white at the base.

LAMIA TRICINCTA.

PLATE XXVI. Fig. 4.

This very fine species is about an inch and a half in length. The antennæ are steel-blue, with dense tufts of hair on the third, fourth, and fifth joints. The head and thorax are covered with short depressed hairs of a brassy green or bluish tint; the latter has two small tubercles on each side. The elytra are similar in colour to the thorax, the back

usually somewhat shining, and the whole surface is thickly punctured: there are three remote bands of black composed of soft hairs, and having the appearance of velvet, the hairs of the anterior band longer than in the others, and frequently forming a considerable tuft towards the suture. The under side of the body and the lower half of the thighs are closely covered with depressed hairs of a deep and beautiful red; the other parts of the leg are steel-blue, glossed with green above. An extensive series of specimens have lately been procured from Java.

Of the last tribe of the long-horned beetles, termed LEPTURIDÆ, the example figured is named

DESMOCERUS CYANEUS.

PLATE XXVI. FIG. 3.

Stenocorus cyaneus, *Fabr.*—*Olivier*, iv. No. 69, pl. 3, fig. 26.

It is of a dark-blue colour, somewhat shining, roughly punctured and pubescent. The head has a longitudinal groove, and there is a similar impression down the centre of the thorax; the latter is in the shape of a truncated cone, with the hinder angles very acute, and almost forming a spine. The anterior half of the elytra is yellow, the other dark blue, with violet reflections. The under parts of the body, and the legs, are dark blue. It is said to inhabit India and other eastern countries of Asia.

The fifth family of tetramerous beetles, according to the system of Latreille, comprehends the genus SAGRA, which has the palpi terminated by an oval joint, the thorax cylindrical, and the antennæ filiform, with the four lowest joints shorter than the others. The hinder thighs are very thick, especially in one of the sexes. The species are confined to Africa, the island of Ceylon, and China.

SAGRA BUQUETII.

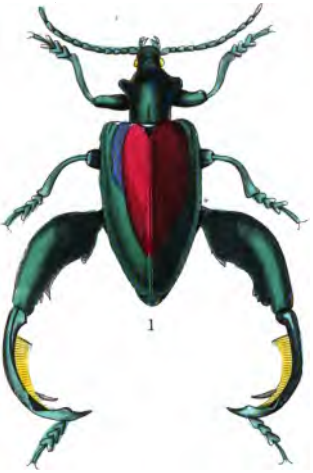
PLATE XXVII.

Lesson's Illustrations de Zoologie, pl. 30.

The male is about thirteen lines long and six broad. The surface of the body is perfectly smooth and polished, of a brilliant green, with purple and coppery reflections of the highest resplendency, especially on the elytra. The hinder thighs are remarkably long and thick, and armed beneath with a few acute teeth; the hinder tibiæ are garnished with long rust-red hairs. The female does not exceed eleven lines in length. The body is not so much narrowed behind as that of the male; the thighs of the hinder legs are oval, and the tibiæ naked. It inhabits Cochin China, and is probably synonymous with *S. Boisduvalii* (Dejean), of which we have seen a multitude of specimens from Java.

The CASSIDÆ, or Tortoise-beetles as they are sometimes called, are chiefly remarkable for a habit

PLATE 27.



Sagra Buquetii.
1. *male.* 2. *female.*

Lizars sc

PLATE 28.

1

2

3

4

5

6

1. *Cassida bicornis.*
2. ——— *scalaris.*
3. ——— *micans.*
4. ——— *echinata.*
5. ——— *perforata.*
6. ——— *luctuosa.*

Lizars sc.

which they practise in common with several allied kinds, that of covering their bodies, when larvæ, with their own excrements. In order to enable them to do this with facility, they are provided with a forked process issuing from the anal extremity, which can be turned upwards, and laid along the back. Upon this they deposit their excrement, and support the load in such a manner as to cover the body. This singular covering is probably designed to shelter the tender body of the larva from the air and sun, and at the same time to conceal it from birds. The outer shell of the perfect beetle considerably overlaps the body, and the legs can be drawn completely within it. The species are very numerous, and many of them highly ornamental, as will be seen from the adjoining figures.

CASSIDA BICORNIS.

PLATE XXVIII. Fig. 1.

Fabr. Ent. Syst.—*Olivier*, vi. No. 97, pl. 4, fig. 59.

The colour of this insect is bluish green, except the antennæ, which are black with the radical joints bronzed. The thorax has two or three small impressions; and the elytra, which are punctured, have a long obtuse spine projecting sidewise from each shoulder. It occurs in Cayenne, Surinam, and other parts of America.

CASSIDA SCALARIS.

PLATE XXVIII. Fig. 2.

Fabr. Syst. Eleuth.—Olivier, vi. No. 97, pl. 4, fig. 94.

Thorax rounded anteriorly, yellow, with a portion of the middle red, in which are two yellow points. The scutellum is red. The elytra are pale yellow, with three broad longitudinal black stripes, of which that on the suture is broken into square spots, and the lateral ones have each a square piece separated from the apex. The under parts are yellow. Said to be found in Sumatra.

CASSIDA MICANS.

PLATE XXVIII. Fig. 3.

Fabr. Syst. Eleuth.—Olivier, vi. No. 97, pl. 5, fig. 83.

In this insect the antennæ are yellow, with the two last joints black; the thorax yellow, and nearly transparent; the elytra yellowish brown on the disk, a stripe of that colour extending to each of the anterior angles, and two others from the hinder extremity across the dilated margin, which, as well as the under parts of the body, is pale yellow. Found in Java.

CASSIDA ECHINATA.

PLATE XXVIII. Fig. 4.

Fabr. Syst. Eleuth.—Olivier, vi. No. 97, pl. 5, fig. 86.

This curious species has the thorax very much dilated on each side into a thin foliaceous membrane, which is dentate round the margin. A similar expanded portion, likewise dentate on the edge, surrounds the elytra; the latter have the anterior half green, and the hinder part reddish brown. The under side of the body is dull yellowish red. Like the preceding species, it is a native of Java.

CASSIDA PERFORATA.

PLATE XXVIII. Fig. 5.

Fabr. Syst. Entom.—Olivier, vi. No. 97, pl. 4, fig. 58.

The colour is yellowish red, dull above, but shining beneath. The thorax is short and transverse, the sides drawn out into a kind of spine. The elytra are nearly triangular, the basal angles advanced on each side of the thorax in the form of an acute point; and there is an oval perforation observable near the base of each. It is found in the tropical parts of America.

CASSIDA LUCTUOSA.

PLATE XXVIII. Fig. 6.

Olivier, vi. No. 97, pl. 4, fig. 54.

Head and thorax black, the latter short, and terminating in an acute point at each of the hinder angles. The elytra are likewise black, with all the outer edge, a small portion of the suture, and a short line near the middle of each, reddish; the under side and legs are also of that colour. It is found at Surinam.

CASSIDA SIX-PUSTULATA.

PLATE XXIX. Fig. 1.

Fabr. Syst. Entom.—Olivier, 97, pl. 3, fig. 36.

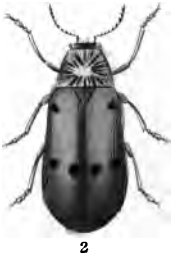
This well-known species is bluish green above, and shining black beneath. The elytra are gibbous on the back, the surface thickly punctured, and each of the wing-cases marked with three spots of red. It is found in Brazil, where it is rather common.

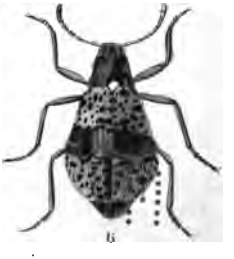
ALURNUS MARGINATUS.

PLATE XXX. Fig. 1.

The Alurni have antennæ of equal thickness

PLATE 29.

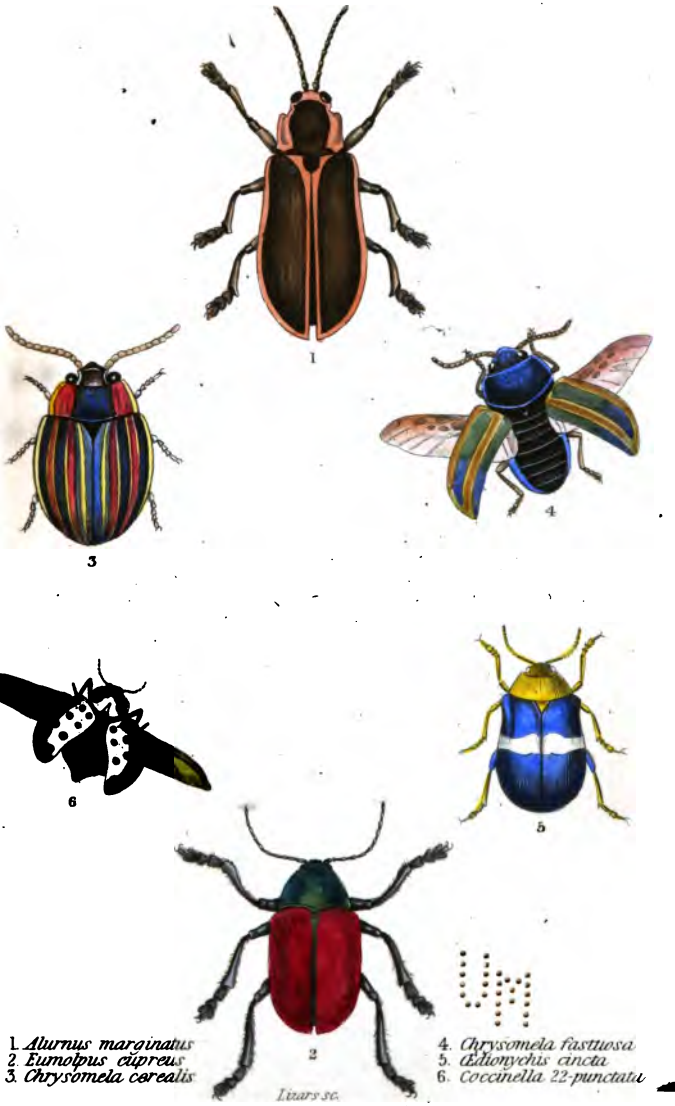




1. *Cassida sexpustulata*. 2. *Clythra hirta*. 3. *Chlamys monstrosa*.
4. *Doryphora tessellata*. 5. *Erotylus histrio*. 6. *Sphenisceus erotyloides*.

Lizars sc.

PLATE 30.



1. *Alurnus marginatus*
2. *Eumolpus cupreus*
3. *Chrysomela cerealis*
4. *Chrysomela fastuosa*
5. *Edionychis cincta*
6. *Coccinella 22-punctata*

throughout their whole length, with the second joint shorter than the following, and they are directed forwards; the body is oblong; the head not concealed within the thorax, and the mandibles are furnished with only two or three teeth. *A. marginatus* is very common in Brazil, and always frequents the leaves of plants. It is of a dull brownish-black colour above, with the sides of the thorax, outer edge of the elytra, and the suture, margined with blood-red. The head, and all the under parts of the body, are likewise of that colour, the apex of the thighs, the tibiæ, and tarsi, being black.

CLYTHRA HIRTA.

PLATE XXIX. Fig. 2.

Fabr. Syst. Eleuth.—Olivier, No. 96, pl. 2, fig. 18.

The head, thorax, and scutellum, as well as all the under parts of the body, are blue, and covered with rather long ash-coloured hairs. The elytra are brownish red, with three black spots on each, one on the shoulder and two others behind the middle. It occurs in Barbary.

CHLAMYS MONSTROSA.

PLATE XXIX. Fig. 3.

Fabr. Ent. Syst.—Olivier, vi. No. 96, pl. 1, fig. 1, *a*, *b*.

In this singular genus, the thorax rises in the middle into a tuberculated protuberance, and is produced behind in the form of a triangle; the suture of the elytra, except at the base, is armed with little teeth, alternating with each other like the cogs of a mill-wheel;* and in certain species the palpi are forked. A considerable number of these insects are known, and all of them are proper to the new world. They are found on leaves, over which they walk very slowly, and simulate death when attempted to be seized. They appear never to make use of their wings, but are usually observed adhering to a leaf, and continuing quite stationary. When in this posture, they bear a much greater resemblance to a piece of withered fungus, or some gelatinous substance shrivelled by the sun, than to any living creature. The species figured is about five or six lines long, of a uniform violet blue, the thorax with a somewhat silky gloss, and the elytra much wrinkled, tuberculated, and punctured. The segments of the abdomen are drawn within each other like the tubes of a telescope, and the penultimate one has a deep rounded impression in the middle.

* Introd. to Ent. iii. 597.

EUMOLPUS CUPREUS.

PLATE XXX. FIG. 2.

The Eumolpi differ from the allied genera in having mandibles of ordinary size, and the second joint of the antennæ much shorter than the following. The species are pretty numerous, and many of them are insects of great beauty. They are usually found on the leaves of plants, sometimes associated in considerable numbers. This is the case particularly with *E. fulgidus*, one of the largest kinds and the most common in Brazil. The species represented is a native of America. The head, thorax, and scutellum, are greenish blue, of a very beautiful tint, especially when moistened. The elytra are closely but distinctly punctured, of a rich coppery red glossed with green. The under side and legs are bluish green, the latter somewhat pubescent towards the foot.

The extensive genus CHRYSOMELA is characterised by the body being ovate and very convex,—by the antennæ thickening slightly towards the apex,—and by the dilated and somewhat hatchet-shaped terminal joint of the maxillary palpi. The name, which signifies an apple of gold, has been suggested by the rounded form and rich colouring of the species. In the last particular, they are not inferior to any of our native insects, many of them

being embellished with agreeable combinations of scarlet, azure, and golden green, with a high degree of lustre. They are strictly herbivorous; and as many of them are gregarious in their habits, they sometimes occasion much injury to herbaceous plants, by stripping them of their leaves. About thirty different kinds inhabit this country; of these perhaps the most beautiful is named

CHRYSOMELA CEREALIS.

PLATE XXX. FIG. 3.

Linn. Syst. Nat.—Fabr. Syst. Entom.—Donovan's Brit. Insects, iv. pl. 115.

It is of a brilliant coppery red above, with parallel stripes of blue along the thorax and elytra. The under side of the body and the antennæ are usually brownish, at other times inclining to purple. The wings are of a fine scarlet colour. It is found on the common broom, and is not uncommon in some parts of the Continent. In this country it is very scarce, and was long regarded as a doubtful native; but the recent occurrence of several examples in Wales has removed all uncertainty on this point.

CHRYSOMELA FASTUOSA.

PLATE XXX. Fig. 4.

Linn. Fabr.—Donovan's Brit. Insects, vi. pl. 194.

Brilliant golden green, with the suture and a stripe along each elytron violet blue. The length is about three lines. It is found on the White Dead Nettle (*Lamium album*), and occurs not unfrequently both in England and Scotland.

DORYPHORA TESSELLATA.

PLATE XXIX. Fig. 4.

Olivier, v. No. 91, pl. 4, fig. 6.

This genus is well discriminated from the other chrysomelinæ by the character which has suggested the name,* viz. the long conical horn projecting from the breast. The species are peculiar to South America, in some countries of which they are much more numerous than the chrysomelæ properly so called. They are usually observed walking slowly on the leaves of plants, and they permit themselves to fall to the ground when one approaches. When handled they discharge from the mouth a yellow liquor of a fœtid smell. The species above refer-

* From δορυφορος, *a pike-bearer.*

red to, is very convex, smooth, and glossy. The head and thorax are glossy black, with a brassy lustre, and without punctures. The elytra are punctured, of a yellow colour, with five cross rows of large quadrate black or brown spots, that next the apex consisting of only two. The under side and legs, as well as the outer margins and suture of the elytra, are black.. The length is nearly nine lines.

ŒDIONYCHIS CINCTA.

PLATE XXX. Fig. 5.

Œdionychis is one of the sub-genera into which the extensive genus Haltica of Linnæus has recently been divided. The species are distinguished from most other tetramerous beetles, by the thickened hinder thighs, by which they are enabled to leap to a considerable height into the air. Most of them are of small size, but they are finely coloured, and very destructive in their habits. The species named *cincta* is of a yellow colour on the head, thorax, and scutellum. The elytra are violet blue, shining, with a band of white across the middle, which widens at the suture. The under side and antennæ are pale yellowish red, the legs being of a similar colour, except the hinder thighs, which are bluish. It occurs in St Domingo.

The only remaining family of the tetramerous beetles that requires to be noticed, is named Cla-

VIPALPI, on account of the large size of the terminal joint of the maxillary palpi. It includes only a few genera, some of which consist of small insects with a hemispherical body, which they have the power of contracting into a ball. The larger kinds, which do not possess this property, are chiefly referrible to the genus Erotylus of Fabricius. The latter well exemplify the distinctive character of the family, as the last joint of the maxillary palpi is unusually large, transverse, and attached by the middle to the stalk of the palpus, bearing considerable resemblance to a hammer. The species are numerous, amounting to nearly one hundred and thirty; and they occur chiefly in the tropical countries of America, if indeed they are not confined to these regions. They are said to frequent leaves, and are observed flying about in the woods during the day. They are solitary in their habits, with the exception of *E. sphacelatus* (Fab.), which is usually found congregated in considerable numbers on the trunks of fallen trees. The species figured is not rare. It is named

EROTYLUS HISTRIO.

PLATE XXIX. FIG. 5.

Fabr. Ent. Syst.—*Olivier*, v. No. 89, pl. 2, fig. 12, *a*, *b*.

It is about an inch long; the head, antennæ, and thorax black; the elytra, which are very much ele-

vated in the middle, are likewise black, with irregular bands formed of yellow confluent spots; two of these spots, one on the shoulder of each elytron, and another at the apex, are reddish; the surface is marked with dark impressed points, which form irregular lines anteriorly. The under side and legs are black. The markings vary much, in some instances the black bands on the elytra being almost obliterated.

SPHENISCUS EROTYLOIDES.

PLATE XXIX. Fig. 6.

Kirby, Linn. Trans. xii. pl. 22, fig. 4.

This genus was established by Mr Kirby on an insect from Brazil, very closely related to Helops. The head and thorax are black and shining, the latter sparingly punctured. The elytra are very gibbous in the centre, marked with punctured lines, of a pale-yellow colour spotted with black, and having a broad band over the middle, and the apex black. The under side and legs are likewise black. The figure of this insect has been accidentally placed among the tetramerous insects, but it belongs to the heteromerous section, as will be seen from the number of joints in the tarsi.

The fourth general division of the Coleoptera, named TRIMERA, includes the kinds with three joints in all the tarsi. As an example of this division, which is comparatively of limited extent, we have figured a beautiful species of the well-known genus Coccinella.

COCCINELLA VIGINTIDUO-PUNCTATA.

PLATE XXX. FIG. 6.

Donovan, Brit. Insects.

It is entirely of a light-yellow colour, having five black spots on the thorax, and eleven on each elytron. It is of frequent occurrence in England.

THE END

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